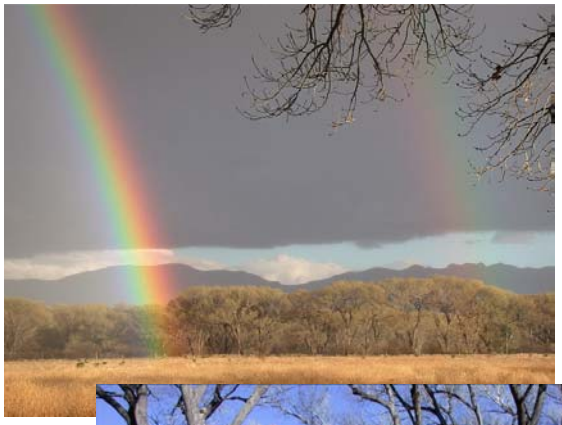
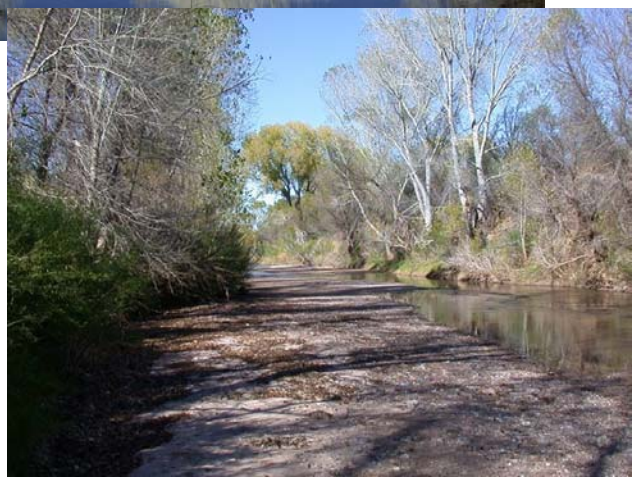
Upper San Pedro Watershed
WILDFIRE HAZARD ASSESSMENT & MITIGATION PLAN
Summary Report

U.S. Department of the Interior
Bureau of Land Management

A Wildland-Urban Interface
Communities-at-Risk Program





HYDROSPHERE
Resource Consultants

ANCHOR POINT

Safford/Tucson Fire Management Zone
San Pedro Riparian National Conservation Area
Cochise County, Arizona **August 2003**

FINAL

UPPER SAN PEDRO WATERSHED
WILDFIRE HAZARD ASSESSMENT AND MITIGATION PLAN
SUMMARY REPORT
COCHISE COUNTY, ARIZONA
AUGUST 2003

A WILDLAND URBAN INTERFACE
COMMUNITIES-AT-RISK PROGRAM

Prepared for:

U.S. Department of the Interior
Bureau of Land Management
Safford/Tucson Fire Management Zone
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Photos on front cover by Jim Mahoney, Arizona BLM
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Introduction

Federal wildland management agencies bear several important fire management responsibilities within wildland urban interface (WUI) areas. "The role of Federal agencies in the WUI includes wildland firefighting, hazard fuels reduction, cooperative prevention and education, and technical assistance." (Federal Wildland Fire Management Policy and Review, 1995).

Wildland fire within the WUI is recognized as a growing threat as urban sprawl rapidly increases. The problem is not new; however, the severity of the problem is increasing as growing populations are drawn to the qualities of living available in the WUI. A growing number of areas in Arizona have a need for fuels reduction, but have not been analyzed for treatment. For fire management leaders, there is the challenge of accomplishing the greatest benefit, to the highest priority areas, with limited funding.

Generally, WUI fuels reduction projects have high per-acre costs compared to other projects. It is important to implement the projects in areas where risk levels are the highest and success is likely (Wildland Urban Interface Risk Determination System for Areas Managed by Arizona Bureau of Land Management, 2000).

The U.S. Department of the Interior, Bureau of Land Management (BLM) funded a Wildfire Hazard Assessment and Mitigation Plan for the lands adjacent to the San Pedro Riparian National Conservation Area (SPRNCA) in the Upper San Pedro watershed, located in Cochise County in the southeast corner of Arizona. Wildfire Hazard Assessments and Mitigation Plans were developed for six communities and three rural areas adjacent to the Conservation area. The details of these assessments are contained in reports for each individual area. This report serves as a summary of the individual reports, and as the technical reference, containing information pertinent to the study but which is less likely to be of interest to the general public.

The wildfire hazard assessment was two-tiered. First, community-level assessments were made for the neighborhoods in the study areas. Second, 444 homes within a quarter-mile of the SPRNCA boundary were surveyed individually, to assess their risk to wildfire. Recommendations for mitigation were made for both the community-level and the individual homes that were surveyed.

PURPOSE

The goal of the Upper San Pedro hazard assessment and mitigation plans is to evaluate the hazards of wildland fire within seven assessment areas adjacent to the SPRNCA, and to identify specific actions that will reduce the risk of loss of life, property, structures and

other valued resources due to wildfire. Specific objectives are listed under the recommendation section at the back of each mitigation plan, though they can generally be summarized as:

- the reduction of hazardous fuels in WUI areas to prevent the spread of wildfires. Recommendations apply to both private and BLM structures.
- increasing cooperation between private land owners, the local fire department and the BLM, and
- increasing the capabilities and efficiency of the local fire department through the improvement of water supplies, neighborhood access, and street and address signage.

NEED FOR ACTION

Wildfire in or around the SPRNCA is not uncommon. Ignition usually results from natural causes, although the percentage of human-caused ignition is high due to the undocumented immigrants (UDI) traffic along the river corridor.

Wildland fire risk is also increased due to the removal of livestock from the Conservation Area. The cessation of grazing has promoted the growth of grasses that result in a high fuel load of fine, flashy fuels.

Both one-time and periodic actions will reduce the risk of loss due to wildland fire. One-time items include the installation of additional water sources and the posting of address numbers to enhance fire department response. Periodic actions include the creation and maintenance of fuel breaks, and conducting controlled burns to reduce fuel loadings.

Objectives

The objective of this project is to provide a comprehensive, scientifically based analysis of the wildfire hazard of the SPRNCA for the BLM. The assessment will aid the BLM in developing short and long-range fuel and fire management plans. This level of pre-planning will assist land managers and local fire officials in making valid, timely decisions for planned and unplanned ignitions. The assessment estimates the hazard associated with wildland fire in proximity to structures. The hazard information in conjunction with values at risk information for a community defines "areas of concern" for the community and allows prioritization of mitigation efforts. The pre-attack plan allows for rapid situational evaluation and access to pertinent information to assist in suppression efforts and prescribed fire planning. In addition to the general objective, several task-specific goals are addressed within this study.

TASK SPECIFIC GOALS

To obtain these objectives, specific goals have been established. These include:

- To promote wildfire awareness and education in the community. Awareness combined with education helps to reduce the risk of accidental human ignitions.
- To quantify the community's risk from wildfire facilitates public awareness and assists in creating public action to mitigate defined hazards.
- To facilitate appropriate hazardous fuel reduction. The prioritization of hazardous fire management areas (FMA) can assist land managers and fire departments in focusing future efforts towards the areas of highest concern from both an ecological and fire management perspective.
- To enhance the capabilities of the fire departments by providing a foundation for pre-attack planning. Rapidly and easily accessing individual home pre-plans and district infrastructure adds efficiency and safety to fire department response and prescribed fire planning.

STUDY AREA PROFILE

The SPRNCA is located in the southeast corner of the State of Arizona. The Conservation Area is located approximately 70 miles southeast of Tucson, encompasses 56,000 acres (22,600 Ha) and has an average elevation of approximately 4,600 feet (1409 m). There are several population centers included in the project area, including the cities of Sierra Vista, St. David, Tombstone, and Palominas.

The San Pedro River flows north from Mexico into the United States. The SPRNCA is designated as a national conservation area due to the high number of animal species found in the area. These include both resident species as well as a high number of migratory birds.

Political statistics include:

County Seat: Bisbee, AZ

Population: 117,755 County wide (2000 census)

Labor Force: 39,262 (est.)

Land Area: 6,215 Sq. Miles

Major Industries: Farming, Ranching, Tourism, Military

The area is considered to be in the Chihuahan Desert ecoregion. Predominant vegetation of the area is characterized as trans-Pecos shrub savanna; gramma-tobosa desert; grasslands; oak-juniper woodland; and mesquite-tarbush desert scrub.

The study area covers the SPRNCA including the developed lands of the surrounding communities. The study area is approximately 173 square miles (44,800 hectares) in size.

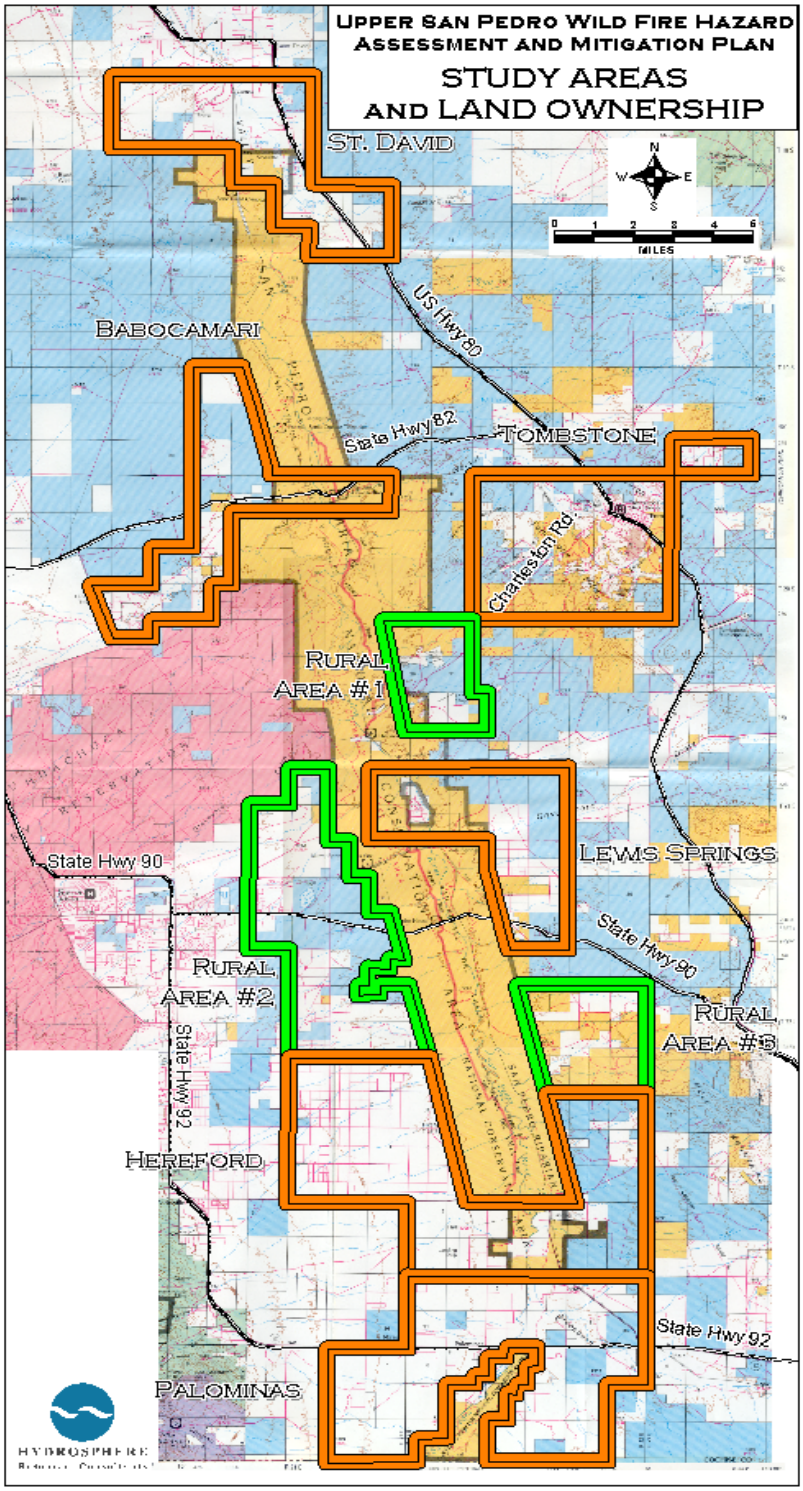


Figure 1. General Location Map

Summary of Public Comments and Surveys

As part of the wildfire hazard assessment, comments and suggestions were solicited from fire officials, emergency personnel, government workers and the general public regarding their concerns about wildfire in the upper San Pedro watershed. This process was three-fold. First, questionnaires were sent out to fire personnel and other officials with districts around the SPRNCA. Next, interviews were held with key fire officials from departments who deal directly with the SPRNCA lands. Third, public meetings were held to solicit concerns from the general public.

In addition to conducting personal interviews with the St. David, Tombstone, Fry and Palominas fire chiefs, we mailed surveys to members of the Cochise County Fire Chiefs Association. This included the state and county health department, the Cochise County communications supervisor, and city and county planning departments. Responses were obtained from 27 of the 43 people contacted about completing a survey. The following are the concerns expressed by this group.

1. There was no consensus on what area had the highest wildfire risk. Answers included the grasslands outside the riparian zone to the cottonwoods within the zone, and ranged from the Mexican border to St. David. Neither was there consensus about where there was less risk. This group was asked to rate the fire hazard to residences on a scale from low to high. Of the 16 that answered the question, 38% (6) said High, 44% (7) said Moderate to High, 12% (2) said Moderate, and 6% (1) said Low to Moderate. None said Low.

2. Fire and other officials were asked what they thought would be the most effective way to mitigate or reduce the wildfire hazards (fuels reduction, building codes, prescribed fire, etc). Of the 20 that responded to the question, 60% (12) said fuels reduction (prescribed fire and mechanical thinning), 10% (2) said grazing, 20% (4) said additional public education (both on creating defensible space, and on fire prevention and awareness), and 10% (2) said to do something to reduce the UDI traffic along the riparian corridor.

3. The respondents were asked what the BLM could do to assist in reducing the risk to these high hazard areas. Of the 19 that answered the question, 53% (10) said fuels reduction, 16% (3) said establishing firebreaks between public and private land, 16% (3) said supply additional equipment and manpower, 11% (2) said provide additional education to homeowners about their responsibility for creating defensible space, and 4% (1) said to work on better interagency cooperation.

4. Respondents were asked what type of fire education programs they had been involved in. Several of the local fire departments conduct outreach to residents in their districts about wildfire hazards and the need to create defensible space. These were done primarily by local firefighters on volunteer time. Some used education in the public schools to provide material to the children, which was to be taken home. There was some mention of using Firewise literature.

5. The question was asked, "Are there locations or properties that have high environmental, cultural or economic value that should be a priority for fire risk reduction?" Property-specific answers included:

    a. Ramsey, Ash and Miller canyons (environmental)

    b. The railroad (historic and economic)

    c. Fairbank (historic)

    d. Whetstone landfill (hazmat)

    e. Gas pipelines (explosion hazard)

    f. Properties where the BLM owns conservation easements alongside the SPRNCA (environmental)

    g. Archeological and paleo sites along San Pedro Corridor, e.g. Lewis Springs (historic cultural resource)

    h. Historical buildings east of Sierra Vista, e.g., railway station, stage coach stop (historic cultural resource)

    i. The monastery on highway 80 (historic cultural resource)

    j. Coronado National Memorial (historic cultural resource)

    k. Old Bisbee, a National Historic Site (historic cultural resource)

    l. Boquillas Ranch (historic cultural resource)

6. Of the 16 responses to the question "Do you feel your community is adequately prepared to combat wildland urban interface fires, 31% (5) said yes, 25% (4) said no, and 44% (7) said somewhat. Of the "No's," the most common reason cited was the limited nature of resources, including volunteer time, equipment, and water, all of which contribute to long response times.

7. Fire officials were asked what they thought would be the most beneficial towards improving fire-fighting capability. Of the 16 who answered, 25% (4) said more training, 19% (3) said additional water supplies, 19% (3) said additional or better equipment, 13% (2) said additional staffing, 12% (2) said additional funding (non specific about use), 6% (1) said better communications (specifically new radios), and 6% (1) said more pre-planning.

8. A summary question was asked about concerns the respondent felt had not been addressed by any of the previous questions. Answers included:

    a. "Improving communications"

    b. Standardizing the incident command system between departments

    c. "Policy issues"

    d. Getting homeowners to take more responsibility for making their homes fire safe.

    e. Increasing funding.

9. Lastly, this group was asked if they knew of any ordinances, covenants or codes that would prohibit wildfire mitigation work. Affirmative answers included,

    a. Lakeside Resort at Parker Canyon had a covenant that prohibited the removal of native vegetation.

    b. "Getting permission to burn because of air quality is sometimes an issue." (Although, from an interview with an employee of the Cochise County Health Dept., there are no restrictions on burning for air quality reasons.)

    c. Endangered species: Southwestern Willow Flycatcher, Huachuca Water Umbel (aquatic plant). San Pedro is also critical habitat for the Spikedace and the Loach Minnow, though none are found there currently.

Three public meetings were held on December 12 and 13, 2002, one each in St. David, Tombstone, and Palominas. The following represent the primary concerns expressed by the general public.

1. All of the residents who spoke expressed a concern about wildfire, and strongly encouraged the BLM to reduce the risk of wildfire. Particularly in the southern study areas, there was the sentiment that the BLM had made commitments to reduce fuels in the past and had not followed through with those commitments. The members of the public who spoke at the meetings were open to fuels reduction via

burning, grazing or mechanical removal. While there were some who preferred one method over others, no one expressed opposition to any of these methods.

2. Some members of the public expressed interest in being allowed to reduce fuels on BLM land adjacent to their private property for a distance of 50 or 100 feet. This included both mowing of grass and cutting of larger fuels. This specific issue is still being considered / discussed.

3. All the public comments received about the local fire departments were positive. The public was generally very satisfied with the level of service that they felt they were receiving for the amount of support they gave the fire department.

Both fire officials and the public mentioned fires started by UDI's. The riparian corridor is a heavily preferred route for people crossing the U.S.-Mexico border. It is not uncommon for UDI's to build campfires when they stop, and leave them unattended when they continue their travels. Everyone who spoke about the UDI's seemed resigned that realistically there was nothing that could be done to reduce this risk.

Current Hazard-Risk Situation

The risk of wildfire is dependent on many factors, including fuels, weather, topography, and sources of ignition. These factors vary in both space and time.

Figure 2 shows the fire regimes of the Upper San Pedro Watershed, as compiled by the Nature Conservancy. This figure shows the types of fires likely to occur in the watershed, based on fuels and topography. Because of fuel type and loadings, the most sever fires are likely to occur along the west side of the river, where, coincidently, the housing density in the valley is higher.

Figure 3 shows the fire starts reported by fire agencies for 1995-1999, broken down by type. This map shows several areas with higher incidences of fire starts. These include the mountains to the west of the valley, where the predominant fire start mechanism is lightning, and two on the San Pedro River, one just to the south of the main SPRNCA boundary and one just to the north of Escapule. The fires in these areas are primarily due to human causes, quite possibly UDIs moving through the area along the river.

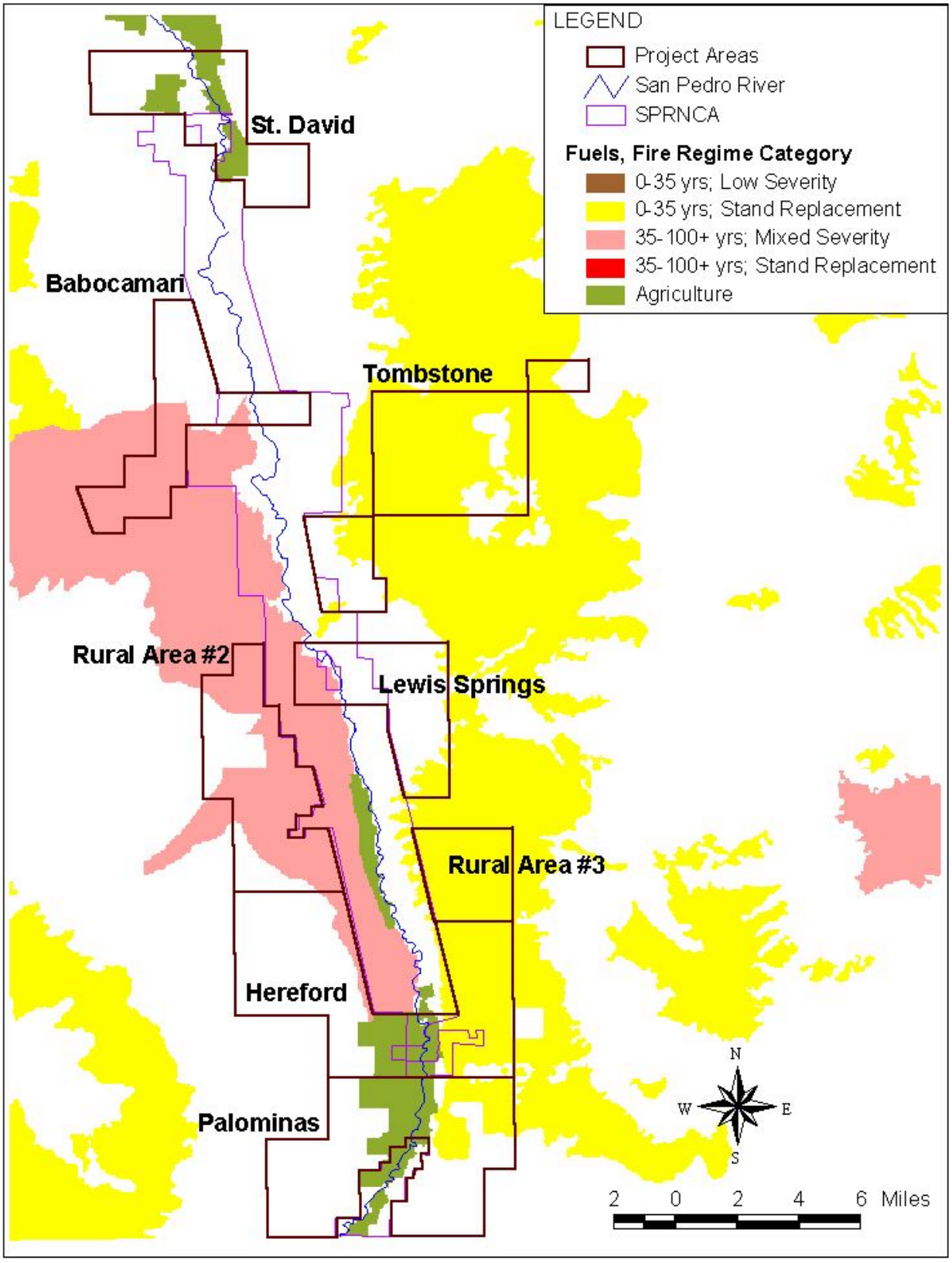


Figure 2. Fire Regimes of the Upper San Pedro Watershed

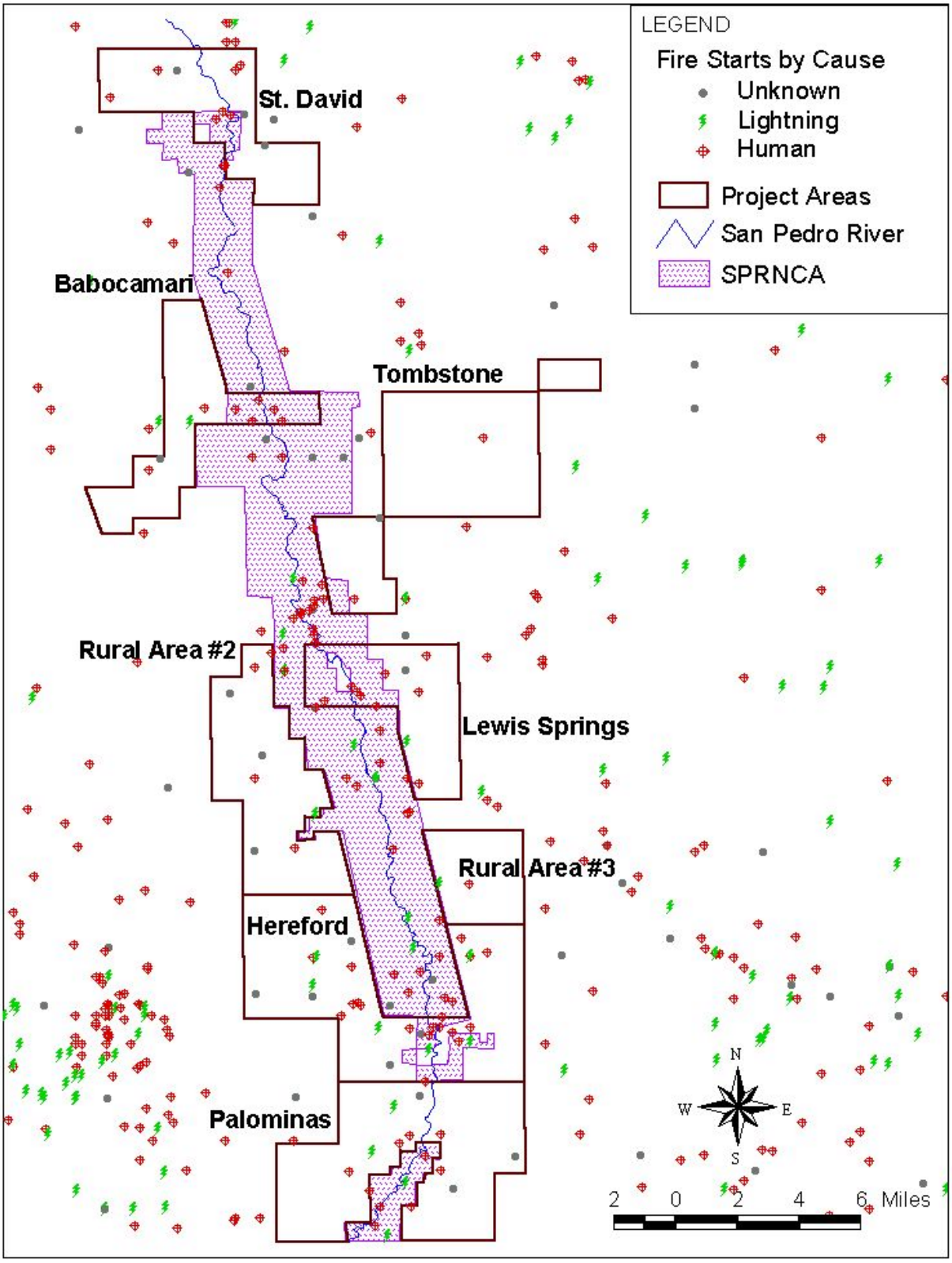


Figure 3. Fire Starts in the Upper San Pedro Watershed, 1995-1999

A Wildfire Hazard-Risk analysis was completed for each of the six communities and three rural areas. To complete this analysis, available methodologies were evaluated, and one selected. After the assessment methodology was selected, the analysis was completed and areas where a high risk of wildfire intersected with homes and other structures were identified.

RISK ASSESSMENT METHODOLOGY

The Risk Assessment and Mitigation Strategies (RAMS) is a methodology for developing wildfire prevention and fuels management programs. RAMS allows users to prioritize areas within their planning unit, consider various prevention and/or fuels treatment alternatives, and develop a budget. RAMS has been the standard BLM methodology for developing and prioritizing wildfire mitigation.

RAMS includes three components: Assessment, Prevention, and Fuels. The assessment portion of RAMS identifies the highest priority areas in which to consider fuels and/or prevention work. The fire prevention module is used to develop one or more fire prevention options, with costs and work details. The fuels analysis section identifies potential fuels treatment strategies and projects. A RAMS report can show any or all of the Assessment, Prevention, or Fuels work.

Many of the input and output data sets created by the Anchor Point hazard risk model and RedZone software are the same as those used by RAMS. Though similar to the Anchor Point model, RAMS was not selected as the methodology for the Upper San Pedro Watershed Analysis for four reasons.

First and foremost, the RAMS Assessment procedure does not use structure density to weight wildfire risk to urban areas. In an areas where housing density is highly variable across the study area, such as in the Upper San Pedro watershed, Anchor Point determined that the Anchor Point methodology, which includes both a physical wildfire hazard and housing density, would provide a more accurate assessment of wildfire hazard in the interface area.

Second, recommendations in RAMS are agency specific and are not generated for non-agency audiences. The Anchor Point methodology generates specific recommendations for local fire districts and individual communities. These recommendations are multi-faceted, and can include such things as multi-jurisdictional training, equipment, modifications to policy and building codes, signage, water supply, and evacuation routes, in addition to standard recommendations regarding fuels mitigation such as mechanical removal and controlled burns.

Third, RAMS does not define what type of treatments to use and where they should be applied. Types and locations are developed by the Anchor Point methodology.

Fourth, once a RAMS analysis is complete, there is no further use made of the data. For the Upper San Pedro assessment, RedZone software was utilized to store the information collected on the 444 homes that were surveyed. This information can be used by fire departments for pre-planning fire fighting scenarios on a community level, and can be printed out and provided to homeowners, allowing them to, at least, simply be aware of hazards around their homes, and, at best, correct at least some of those problems.

HAZARD-RISK ASSESSMENT

A Wildfire Hazard-Risk analysis was completed using the Anchor Point methodology for each of the six communities and three rural areas, and each area was classified by Wildfire Hazard level. From this, Areas of Concern were defined based upon wildfire hazard level and community specific evaluations. This was used to generate maps showing the areas where wildfire mitigation would have the greatest impact at reducing wildfire hazard. Figure 2 shows the Areas of Concern identified for the for all the study areas. Detailed maps of each area are included in the individual mitigation plans.

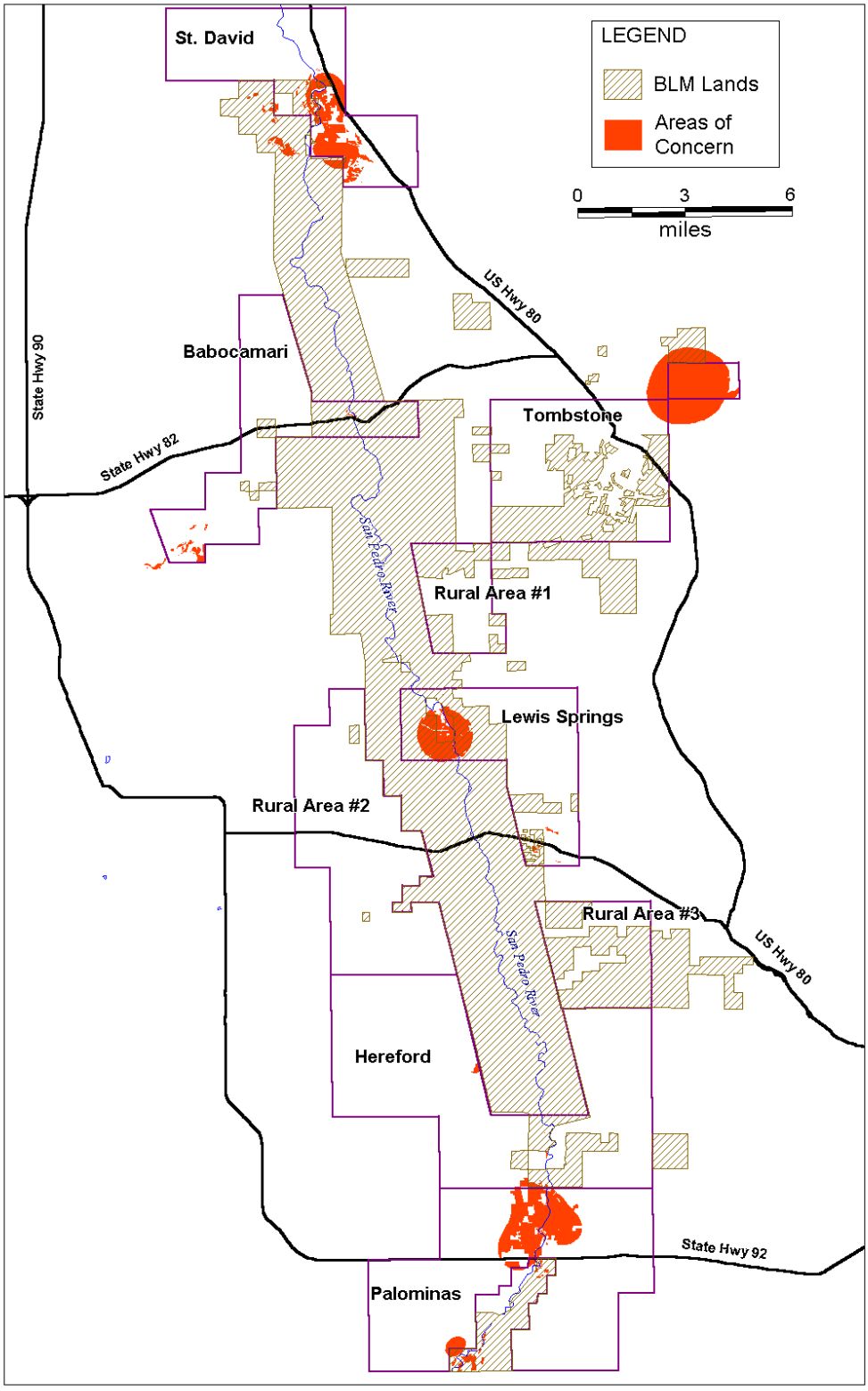


Figure 4. Areas of Concern

In addition to community level surveys, individual home assessments were completed for a total of 441 structures located within the SPRNCA study area boundaries. The results of these surveys were incorporated into a RedZone software database. The data stored by the software can be used for preplanning purposes, planning during a wildfire event, or to provide homeowners with information about what they can do to reduce their risk of loss from wildfire. Table 1 summarizes the results of the hazard assessment.

Table 1. Summary of Wildfire Assessment

	Fire Behavior Index Hazard			Areas of Concern Level		
Hazard Level	**Acres**	**Hectares**	**# Structures**	**Acres**	**Hectares**	**# Structures**
Low	449	181	109	3569	104	14
Moderate	3070	1242	121	265	765	70
High	248	100	0	1889	665	100
Very High	3166	1281	37	1644	621	242
Extreme	2029	821	220	1534	25	58
Sum	8962	3627	487	8962	2183	484

Number of structures from Cochise County parcel data.

Pre-Attack Plan and Recommendations

A comprehensive pre-attack plan was completed for this project within a quarter-mile buffer zone of the SPRNCA. RedZone Software was utilized to organize and display both individual structure assessments and infrastructure identification. This tool allows the user to collect, maintain and use preplanning data. This data includes information concerning homes, roads and other GIS data. It can be utilized to assist with fire education, developing and prioritizing future projects and to support an incident in size-up, stabilization, property conservation and fire control. The software is designed specifically for firefighters in the field.

The software package utilized in the assessment and provided to the BLM has three distinct elements.

The project field staff utilized comprehensive field surveys, which were integrated into a Personal Digital Assistant (PDA). Diverse types of preplanning data were collected.

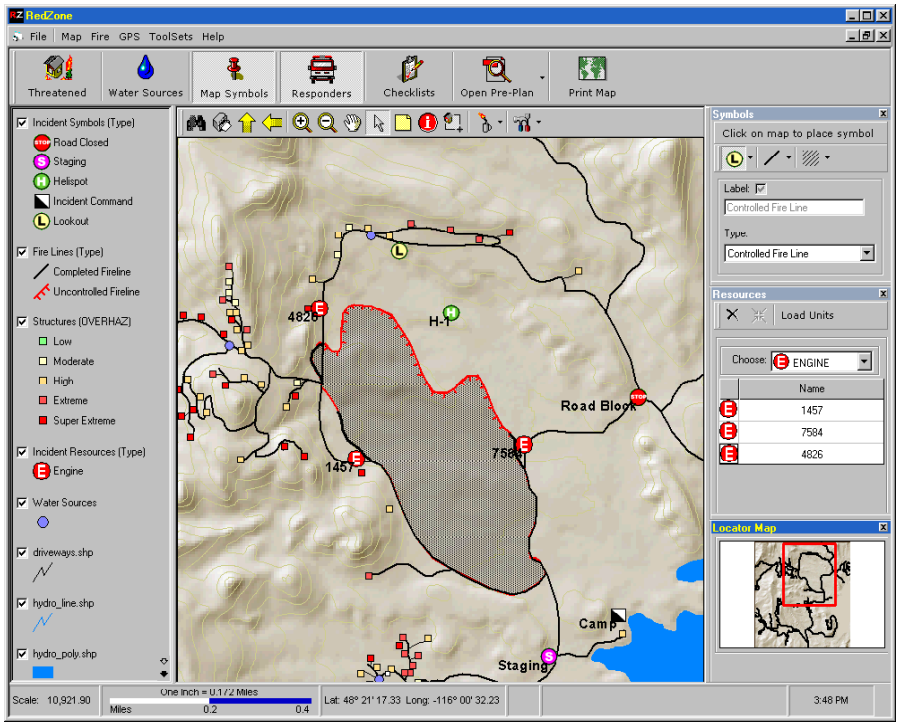
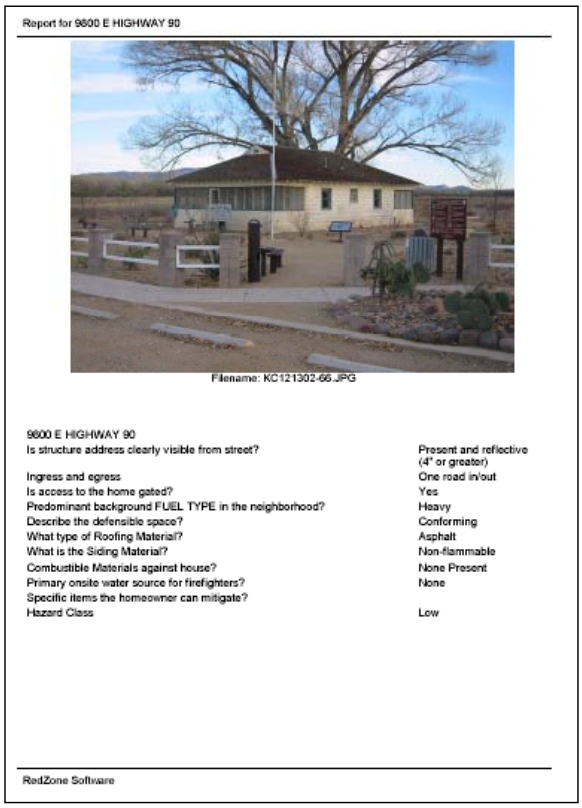


Figure 5. Example of RedZone Software Interface



Report for 9800 E HIGHWAY 90

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9800 E HIGHWAY 90

Is structure address clearly visible from street?	Present and reflective (4" or greater)
Ingress and egress	One road in/out
Is access to the home gated?	Yes
Predominant background FUEL TYPE in the neighborhood?	Heavy
Describe the defensible space?	Conforming
What type of Roofing Material?	Asphalt
What is the Siding Material?	Non-flammable
Combustible Materials against house?	None Present
Primary onsite water source for firefighters?	None
Specific items the homeowner can mitigate?	
Hazard Class	Low

RedZone Software

The Utilities program allows RedZone to not only collect information, but also maintain it over time. The program provides tools to update field data as well as to collect complex GPS data, customize and print maps, analyze homes based on hazard criteria, and many other tools.

One exceptional feature of Utilities is the ability to instantly generate a mitigation report for any home surveyed. An example of one such report is shown to the left.

Figure 6. RedZone Mitigation Report

DATA ELEMENTS COLLECTED

Data collected for individual home surveys included:

- Topography
- Aspect Class (N-S-E-W)
- Defensible Space
- Vegetation / Fuel Types
- Predominant fuel model class
- Flammable materials storage
- Determination of vegetation near Chimney or Stovepipe
- Street address
- GPS of house pad location
- Photographs of structure

- Roofing material classification
- Balcony & Deck classification
- On-site Access classification
- Water supply
- Off site Access
    - Ingress / egress to the driveway
    - Road width
    - Maximum grade

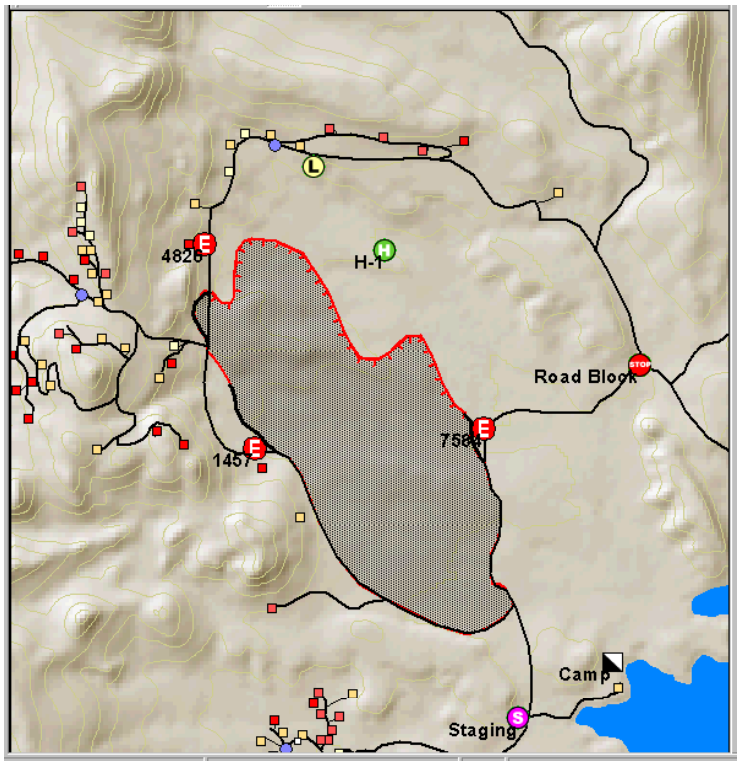


Figure 7. Example of RedZone FireDirect Screen

During fires, the FireDirect program is an invaluable tool for providing spatial data. From access restrictions to water availability for individual structures, it provides critical information to firefighters in the field. FireDirect also has the capability of tracking responding engines and crews, importing fire perimeters and create standard ICS maps and forms. The software has been populated with a comprehensive database specific to the SPRNCA. It is configured to accept increasing and wide-ranging database information.

RECOMMENDATIONS

- The BLM with input from the representative fire district should continue to update and increase the data available to the software.
- Future fire perimeters and confirmed starts should be recorded to develop trends.
- New water supply installations should be noted and marked on the GIS.
- New homes and completed mitigation efforts should be recorded.

WILDFIRE HAZARD RATING

The Fire Behavior Index theme shows the results of the Wildfire Hazard Evaluation. This theme represents only a potential hazard classification for a site. It does not include a full wildfire risk evaluation, i.e., the probability that a wildfire will occur except as captured in the adjustments for elevation as noted above. Some sites with a high hazard may, in fact, have a low probability of an event occurring and vice versa.

The color values for the various hazard levels are overlaid onto the 2-meter aerial photo.

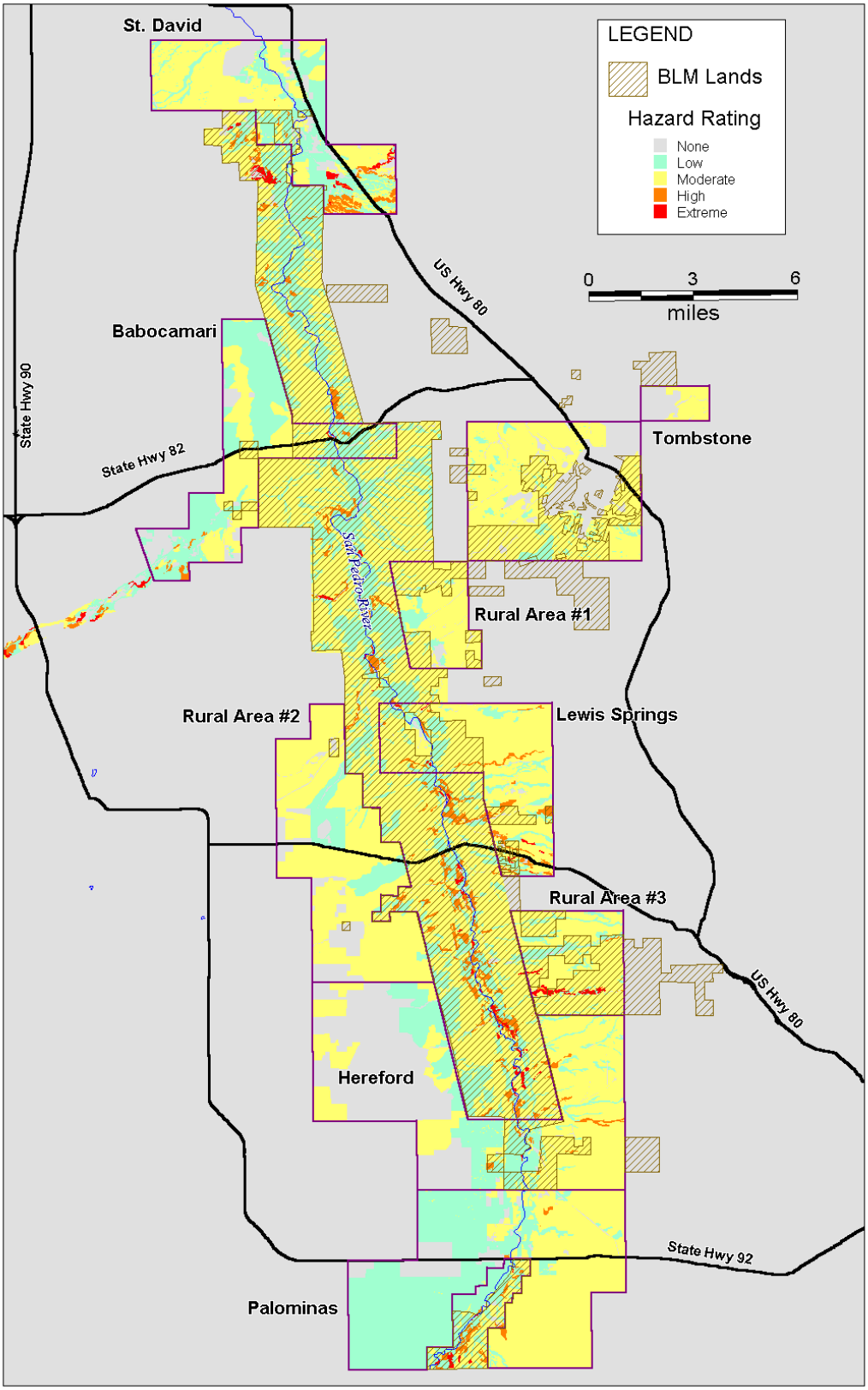


Figure 8. Fire Behavior Index Based Upon Fuels

VALUES AT RISK RATING

The Structures per Square Mile Theme shows the results of the Values at Risk assessment. This theme represents an evaluation of the values at risk based only on the presence and location of structures within the analysis area. Possible additional resources / values such as timber resources, wildlife habitat, recreation potential, etc., were not included within the present assessment due to resource restraints. Such additional resources / values could be included in an expanded analysis of the values at risk. This classification represents only an assessment of the resources / values at risk. It does not include the wildfire hazard assessment, i.e., the level of hazard for the location (See the Wildfire Hazard Evaluation in the previous section). Some sites with a high number of values at risk may, in fact, have a low hazard and vice versa. In addition, an evaluation of the probability of occurrence (actual level of risk) of a wildfire event was not performed due to lack of data required to support such an analysis.

The Values at Risk assessment was based upon the density of structures estimated from developed parcels centroids.

The Values at Risk classification is shown in Figure 9.

WILDFIRE HAZARD-RISK EVALUATION - AREAS OF CONCERN RATING

The Areas of Concern Theme shows the results of the Areas of Concern Evaluation in which the Hazard Classification is combined with the Values at Risk assessment. Figure 10 shows the Areas of Concern for Lewis Springs. An Area of Concern graphic is included in each of the community reports.

The Areas of Concern analysis and resulting map is a tool to assist fire managers in defining future mitigation efforts. It does not reflect a ranking of hazard or risk to the community from fire. The analysis does not intend to classify the susceptibility of the neighborhood or community from fire. The analysis is intended to highlight neighborhoods or communities that are in proximity to wildfire hazards. The overall intent is to help fire managers locate areas where mitigation efforts will benefit the most people and infrastructure in a single geographic area.

The methodology flow is stated below:

A wildfire behavior ArcGIS raster grid is generated based on slope, aspect, fuels and representative weather parameters. This grid is calculated using a 10 meter cell size. This grid is expressed Low, Moderate, High and Extreme classes.

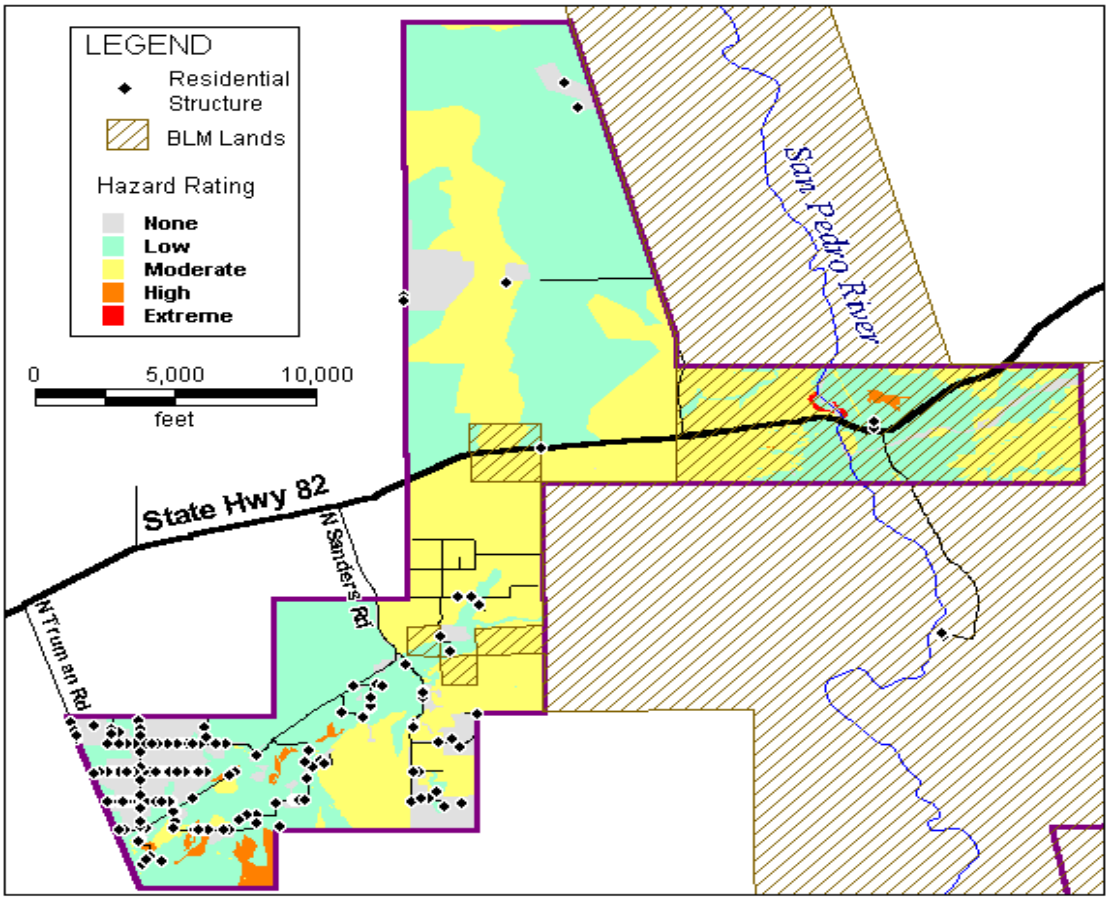


Figure 9. Typical Wildfire Hazard Map

A structure density grid is then generated and is expressed in homes per square mile. This grid is calculated using a 10 meter cell size. Structure density is reclassified into Low, Moderate, High and Very High classes. This classification is based on statistical analysis of the density of homes per square mile.

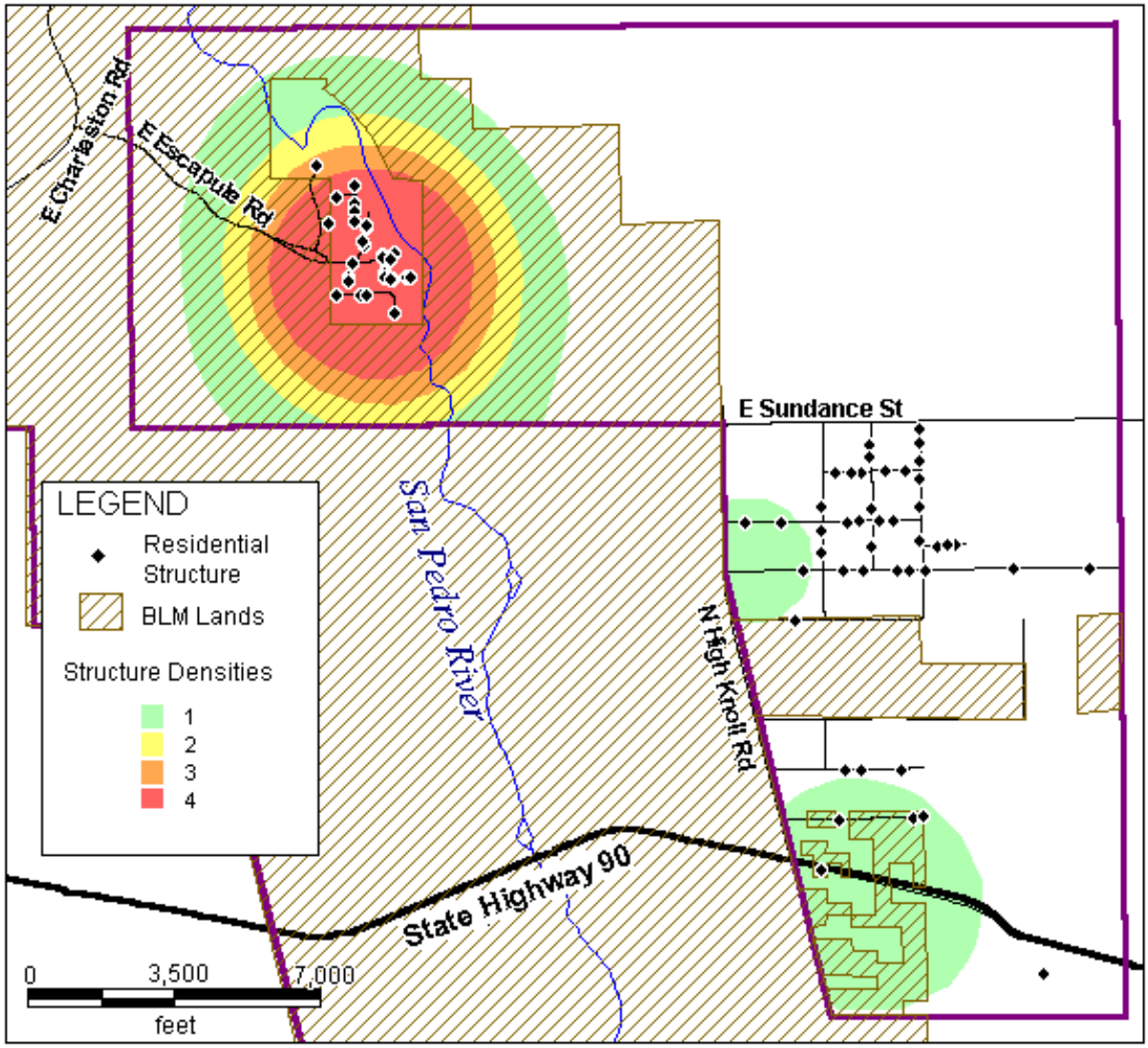


Figure 10. Typical Structure Density Map

There are several factors that are considered in generating the structure density. Only homes within 1/4-mile of the BLM land boundary were considered because homes outside this area include structures in urban settings not considered to be interface areas but are in a high-density configuration effectively skewing the areas of concern into non-interface areas, and homes outside this area generally fall into high desert fuel profile with a significant reduction in fire behavior predicted.

The greatest potential for ignition and historic ignitions is within the SPRNCA. Fire effects including fire brand ignition are not likely to affect areas beyond the 1/4-mile boundary.

Only homes with a hazard rating of moderate and above were included in the density factor. Homes with a low rating are considered to be "stand-alone" or not needing mitigation and therefore were not allowed to influence the Areas of Concern map.

The reclassification and combination of wildfire hazard and structure density grids leads to the Areas of Concern map. The final grid is based on the Area of Concern grid and shows only the areas of highest concern. This is done for the following reasons:

- To focus land and fire managers on only the areas which will benefit most from assistance with fuels reduction and other mitigation efforts.
- To not overwhelm citizens and land managers with a statistic that can be easily misinterpreted.

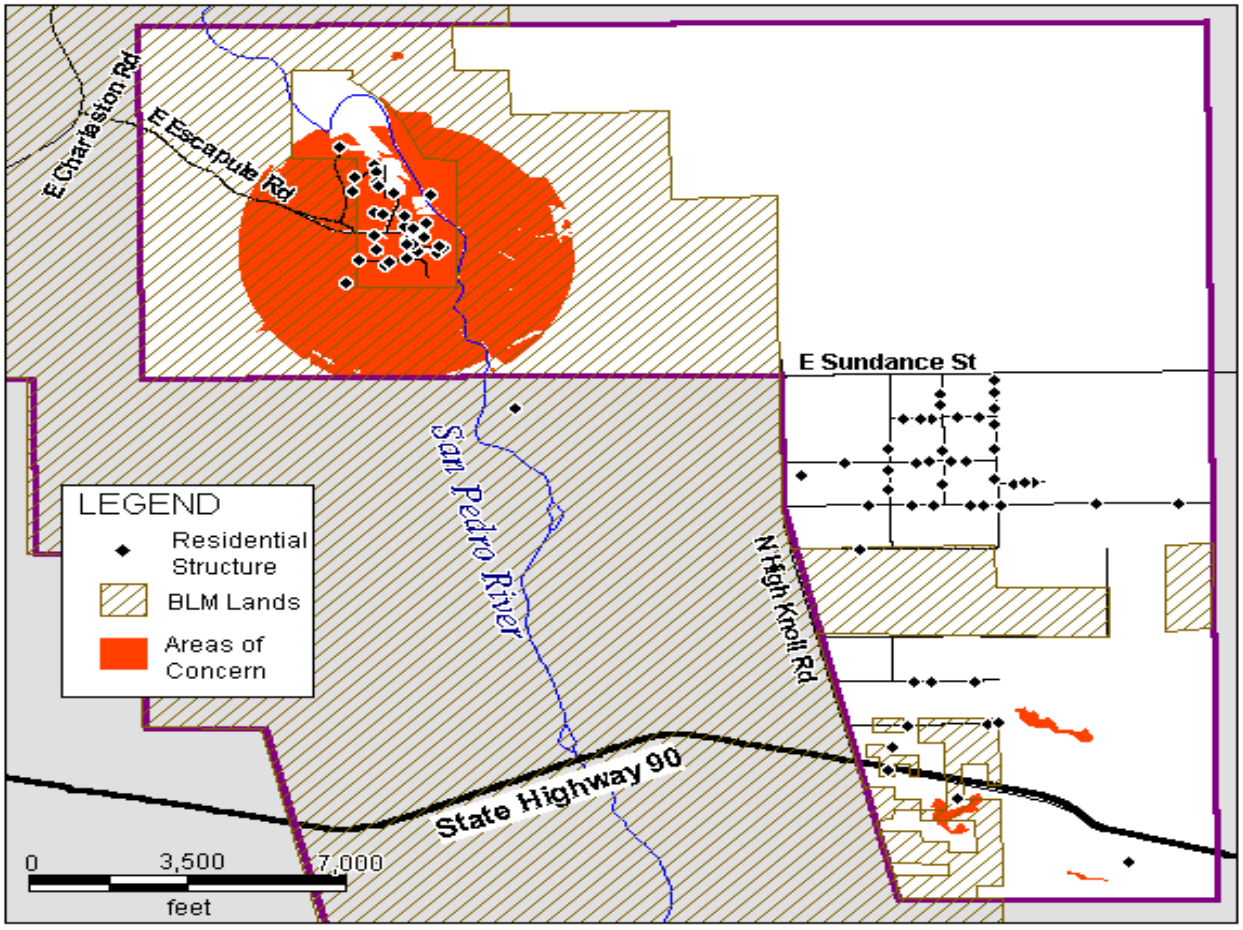


Figure 11. Typical Area of Concern Map

Figure 11 shows the areas of concern for all seven of the study areas. Detailed maps of each area can be found in their respective reports.

Summary of Issues and Recommendations

This section summarizes the issues surrounding the Hazard Assessment and Mitigation Plans, and makes specific recommendations to improve each of these areas.

RECOMMENDED MITIGATION

Fuels reduction for firebreaks and evacuation routes are recommended for individual communities. These include:

Table 2. Summary of Recommended Mitigation

Community	Name	Width (feet)	Length (feet)	Area (acres)	Land Ownership
Babocomari	Firebreak	50	22,000	25	Private, State, BLM
Hereford	South Hargis Ranch Road firebreak	50	4,300	5	BLM
	South Hereford Road firebreak	50	3,700	4.2	Private, BLM
	East Hereford Road Evacuation Route firebreak	70	2,050	3.3	BLM
	Unnamed Road Evacuation Route firebreak	70	3,650	5.9	BLM
Lewis Springs	Escapule escape route	100	2,920	6.7	Private
	Escapule escape route	70	3,500	5.6	BLM
	East Judy Drive firebreak	50	1,400	1.6	Private
Palominas	South Border Monument Road fuel break	50	9,500	10.1	BLM
Rural Areas	-- None --				
St David	West Escalante Road firebreak	100	2,720	6.2	BLM
	East Campa Lane firebreak	50	2,800	3.2	Private, BLM
Tombstone	North Road firebreak	30	800	0.5	BLM
	Via San Diego firebreak	30	2,100	1.5	BLM
	South 15th Street firebreak	30	500	0.3	BLM
Total			61,940	79.1	

For complete descriptions of the recommended mitigation projects, see the appropriate community-level report.

ONGOING WILDLAND URBAN INTERFACE PROJECTS

The BLM has begun to address the issues of the WUI along the boundary of the SPRNCA. The BLM Safford/Tucson Fire Management Zone has facilitated activities in partnership with the surrounding fire protection districts.

RECOMMENDATIONS

- Digitize any maps representing current and past work completed or initiated in the Project area. Amend the existing database to include new fuel break work conducted by the BLM. Included this data in an overall database and integrate into the RedZone Pre-plan for easy access and map production.

PUBLIC EDUCATION AND COMMUNICATIONS PLAN

As a whole, the fire protection districts, fire departments, and the communities they serve have a practical understanding of the natural world around them and their community. This is in part due to the recent wildfire activity in and around the community. The community prides itself for living in a high desert environment and values the small town lifestyle. There is varied understanding of the intrinsic hazards associated with the "wildlands" they live in. A well-rounded approach to wildfire education, including public, private and district level input would be valuable. Combining the values of the community encompassing - quality of life, property value, the ecosystem, wildlife and safety, will greatly increase the receptiveness of the message.

RECOMMENDATIONS

Provide citizens with the findings of this study including:

- Individual home assessments with recommended mitigation actions.
- Levels of risk and hazard.
- Value of fuels reduction programs.
- Environmental and wildlife values of prescribed fire and fuels management.
- Consequences and results of inaction for planned and unplanned ignitions within Cochise County.

- Utilize these web sites for a list of Public Education Materials and for general homeowner education:
  http://www.nwcg.gov/pms/pubs/pubs.
  http://www.firewise.org/.
- See Appendix D for additional resources.
- Create a WUI citizen advisory council.

This council would provide peer level communication for their community. The citizen advisory council should be integrally involved in current and future public education outreach programs. The committee can also function as a voice for the community in the county planning process for significant future developments in the area. Cochise County does not currently include wildfire as part of its comprehensive land use planning or zoning. A community WUI council / group can assist in the development of future land use regulations and help to ensure that local values are considered and maintained when County level requirements are developed. An initial action for the advisory council could be to assist the BLM to prioritize the value of the recommendations considered later in this report.

COMMUNICATIONS PLAN

Several communications techniques are available to the BLM Safford/Tucson Fire Management Zone to convey the results and findings of this study to the citizens, stakeholders and adjacent Fire Protection Districts.

RECOMMENDATIONS

Web site

- Create a new Wildfire Mitigation web site and have links to the web site placed on:
  - Existing local BLM web site.
    http://azwww.az.blm.gov/azso.htm
  - Chamber of Commerce home page
    http://www.sierravistachamber.org/
  - Cochise County home page
    http://www.co.cochise.az.us/ccwebsite/Default.asp
  - Southern Arizona Chapter of the Red Cross
    http://www.tucson-redcross.org/CochiseCounty
- Include the results of this study with maps and a summary of individual structure ratings.

- Create a File Transfer Point (FTP) site where individual home analysis and recommendations can be posted and viewed by the resident upon request.
    - This information should be password protected.
- Create links to the Arizona State Lands Department, Arizona Game and Fish Department, USDA Forest Service, USDI Fish and Wildlife Service, USDoD Fort Huachuca Military Reservation, Firewise, state and local Fire Departments and other partner's homepages.

Power Point Slide show

- A presentation has been developed which represents this project.
    - Post the presentation on the new web page.
- Utilize the presentation for::
    - Internal BLM briefings.
    - Annual community meetings.
    - A presentation at the local and or state Fire Marshall's meeting.

News releases and direct mailings

- A direct mailing was sent to the local residence at the start of this project.
    - Send a second mailing to announce the completion of the project.
    - Include the new web site address.
- Contact Federal Emergency Management Agency (FEMA) local office to present the efforts and successes on behalf of the local Fire Departments.

Public meetings

- These meetings were conducted in April, 2003.
    - Display the results of the hazard and risk assessment.
    - Invite key stakeholders, press, citizens, Cochise County commissioners and local cooperators.
    - Capture and record questions, comments and concerns from the citizens.
- Utilize this meeting to establish the WUI citizen advisory council.

NEWSLETTER

- Create a newsletter from the WUI council detailing the project and community meetings.

- Produce an annual newsletter with updates on projects and accomplishments.

PUBLICATIONS

- Disseminate wildfire education materials to the following locations.
    - R.V. Parks
    - Trail heads
    - SPRNCA Nature Center
    - Chamber of Commerce
        - Include in visitor packets

FIRE DEPARTMENT INVOLVEMENT

The Fire Departments and Fire Districts within the study area of Cochise County include:

- St. David Fire District
- Tombstone Fire Department
- Babocomari Fire District
- Huachuca City Fire Department
- Fry Fire District
- Sierra Vista Fire Department
- Palominas Fire District
- PBW Fire Department
- Bisbee Fire Department (not in the study area)

These districts and departments have been very involved in wildfire suppression, both in-district and as a mutual aid agency for adjacent districts. Many of the Districts provide fire suppression, rescue and EMS services for the surrounding communities.

Training

Firefighters are called upon to suppress both structural and wildland fire. Continuing education in both structural and wildland fire suppression tactics, equipment and safety is essential. Without this training, firefighters face and increased risk of fire-related injuries and fatalities. The Fire departments and Districts within Cochise County should organize their Wildland Fire training into three different levels.

RECOMENDATIONS

- Basic Level Training
    - S-130/190
    - S-215 Fire in the Interface
    - I- 200 Basic ICS
- Supervisory Training
    - S-290 Intermediate Fire Behavior
    - I-300 - Intermediate ICS
- Specialized Training.
- Fire Prevention and Education.
- Awareness / functional level education for the utilization of RedZone Software.
- Prescribed fire implementation and planning.
    - Rx 234
- BLM should facilitate the involvement of local Fire Departments in "cross training" opportunities. This would include joint pre-planning sessions with the BLM and local fire departments to communicate what each entity expects from the other during wildfire events. This will reduce that number of surprises that occur when one entity does or does not do something the other entity expects.
- Provide training opportunities on weekends and evenings to accommodate volunteers.
    - Increase the opportunity for Fire Departments to participate in prescribed fire events.
    - Conduct more prescribed fires on weekends.
    - Require the adherence to NWCG standards to participate.
    - Expand the roll of the fire departments beyond holding and structure protection at fire events, both planned and unplanned.
    - Encourage the utilization of task books to document experience.

Equipment

Fires in the WUI usually require that some firefighters are dressed in wildland PPE while others wear structural PPE. Rapidly changing fire conditions require that firefighters, if on engines, have the ability to change into the appropriate PPE. To do less puts the firefighter at risk.

RECOMENDATIONS

- Adhere to NFPA 1977 Standard on protective clothing and equipment for wildland fire fighting. This standard specifies the performance and design requirements for wildland fire PPE.
- Provide minimum wildland PPE for all firefighters.
    - Refer to NFPA 1977 for specific requirements.
    - Provide *gear bags* for both wildland and bunker gear to be placed on engines responding to fire calls. This will help ensure that responding firefighters have both bunker gear and wildland PPE available when the fire situation changes.
        - Firefighters can keep both sets of PPE in "quick don" bags; the appropriate PPE can be donned for the fire call while the other bag can be quickly placed on the engine.
- Provide and maintain a 10-person wildland fire cache in addition to the tools on apparatus.
    - This will promote successful, rapid initial attack of all wildfires.
- Establish and standardized hose and water supply fitting specifications for all departments within Cochise County and BLM resources.
    - Obtain adapters to conform to new standards
- Rural Fire Departments can apply for Rural Fire Assistance (RFA) funds annually to help them acquire up-to-date PPE and equipment.

WUI COORDINATION GROUP

The most innovative and successful WUI programs are multi-jurisdictional in nature. For a successful wildland urban interface / fuels management program to succeed, the fire departments must partner with the BLM, local mutual aid agencies and the communities of Cochise County as a whole. Citizens must hear and see coordinated collaboration from both the ecological and emergency service perspective.

RECOMENDATIONS

- Improve coordination with municipal and state / federal fire suppression and disaster services organizations.
    - Initiate the development of a WUI Coordination Group
        - This Group should contain, at a minimum, representation from all stakeholder groups, including:

- BLM
- Local fire department(s)
- Cochise County Office of Emergency Management (OEM)
- Red Cross
- Fort Huachuca
- San Pedro NRCD
- Sheriff and Police

▪ This Group can be formed as a "focus" committee under the Cochise County Fire Association.

- Initial actions can include strategies for the implementation of recommendations in this report.

o Initiate the development of a formal Type 3 incident management team.

o Conduct annual tabletop exercises utilizing RedZone Software to simulate fire incidents with a focus on:

▪ Citizen notification
▪ Evacuation
▪ Re-entry of citizens post evacuation
▪ Transitions from initial attack to Type 3 / 2 teams
▪ Initiation of unified command structure
▪ Establish post incident critique format

Fire Management Area Solutions and Mitigation

ESTABLISHING AND PRIORITIZING FIRE MANAGEMENT AREAS (FMA)

An efficient method of prioritizing work efforts is to create Fire management areas. FMA's should be created prior to planning or initiating fuels management projects and other mitigation on public or private lands or around structures. There are unique vegetation and mitigation management activities recommended for each priority area. The FMA's are not ordered in priority ranking. Priority actions should be determined by the local land

management / fire management agencies, under the direction of a citizen's advisory council. Recommendations are presented for the following items.

- Riparian Area Fire Management Area
- Community and Home Mitigation Fire Management Area
- Fuels Reduction Fire Management Area
- Prescribed Fire
- Land Use and Building Codes

RIPARIAN AREA FMA

A stream or river corridor functions as a dynamic crossroads in the landscape. Water and other materials, energy and organisms meet and interact within the corridor. A stream corridor is an ecosystem that usually consists of three major elements:

- Stream channel
- Floodplain
- Transitional upland fringe

Together they function as a dynamic and valued element in the landscape. This interaction provides critical functions essential for maintaining life such as cycling nutrients, filtering contaminants from runoff, attenuating floodwaters, maintaining wildlife habitats, recharging ground water, and maintaining stream flows.

From a fire management perspective, healthy riparian stream corridors can function as fuel breaks as seasonal moisture allows. Effectively managing stream corridors and "linking" them to other functional fuel break areas can help to create a non-continuous fuel profile.

Along the San Pedro River, there is very strong correlation between the health of the stream corridor and its long-term ability to function as an effective fuel break. In this area, the riparian area FMA is typically a corridor 100 feet wide along the river bottom.

RECOMMENDATIONS

- Facilitate the creation of an "Adopt-A-Stream" program for individual groups or neighborhoods. Empower them with the ability to enhance the health, restoration and fire function of the stream corridor.
    - The focus of these efforts should be on the mechanical removal of dead and down fuels in stream bank areas.

        - Appropriate fuels reduction will facilitate the utilization of prescribed fire and create an effective fuel break between the east and west side of the river bottom.
    - Partnering efforts with BLM fuels reduction crews will enhance the effect and efforts of this work
- Develop a master plan to integrate healthy, restored, riparian corridors into an overall fuel break design.

EVACUATION MANAGEMENT FMA

Many of the communities at risk in the study area have limited ingress and egress routes. The community of Escapule has only one primary road in and out of the community. Some roads are poorly maintained and impassable after flooding. If separate ingress and egress routes are not established and utilized in an emergency, a critical traffic flow issue will be created. Vehicle congestion and even full occlusion of roadways is very possible.

Comprehensive fuels reduction projects for egress and access routes may not be feasible due to complex land ownership and the scope of the effort. It is however possible to reduce the fine fuel loading along critical roadways. Mowing within the road right-of-way, approximately 10 feet off of the edge of the road is recommended. This applies for all roads that represent the only access and egress route into a community.

Staging areas

It is also recommended that maximizing the primary vehicle escape and access routes for these communities be accomplished through implementing multiple citizen staging areas.

The use of a safety zone / staging area should also be considered for all communities. These pre-planned safety zones are large enough to accommodate both citizens and staged fire apparatus. These areas are designated as a meeting place where citizens could get more direction and updates before implementing a full evacuation. It is imperative that citizens get approval before evacuating to avoid getting trapped by the fire on a road, or creating hazardous road traffic for incoming apparatus. The concept of citizen staging areas can be applied to subdivision or community levels as well. Local landowners and the local fire department should determine the best sites.

RECOMMENDATIONS

- Post placards clearly marking "fire escape route" and "emergency staging area". This will provide functional assistance during an evacuation, and communicate a constant reminder of wildfire to the communities. Signage should be mounted on non-combustible poles.
- Install a direct 911 call box at the staging areas. This phone would give the citizens direct, priority contact with Cochise County Emergency Services (911) dispatch to obtain clear directions for recommended evacuation procedures.
- Maintain the staging area either by xeriscaping, mowing or a combination strategy. Keep the area clear of all materials, especially hazardous and flammable ones.
- New road construction should be required to create fire safe access, including fuels reduction along the roadway.
    - A pre-plan and a fuel modification project should be implemented for all new roads.
    - Thinning or mowing along critical new road corridors should be completed prior to home construction.

SHELTER IN-PLACE

Shelter in-place means to remain inside a home, business, or other permanent building. Shelter in-place may be recommended when there is not enough time to evacuate. It is imperative that structures be mitigated to provide this option.

RECOMMENDATIONS

The following is suggested public education elements to be provided to all potential "shelter in-place" communities:

- If you are outdoors, go inside immediately.
- Bring pets inside if possible but do not risk your safety for your pets.
- Turn on a local Emergency Alert System radio or television station (KTAN 1420 AM, KWCD 92.3 FM, KAVV 97.7, KZMK 100.0 FM) for official information.
- Close all windows, doors, and vents.
- Turn off heaters, air conditioners, and exhaust fans.
- Close as many internal doors as possible and move to the most central, windowless, above-ground room in the building.

- Wet towels, plastic sheeting, or an airtight material can be used to seal gaps where smoke could enter the room.
- Do not attempt to pick up children from school or day care until directed to do so. School officials plan to care for children in emergencies, and they may already be evacuated, or sheltered. (Before an emergency occurs, learn about emergency plans at schools or day care centers.)
- Stay inside until officials say it is safe to leave.

CITIZEN NOTIFICATION

Establishing a citizen notification procedure is essential in promoting coordinated evacuation.

RECOMMENDATIONS

- Develop a reverse 911 system for efficient notification
- Utilize local television and radio stations
- Expand any existing disaster notification systems to include wildfire notifications.

Home Mitigation Fire Management Area (FMA)

Community responsibility for self-protection from wildfire is essential. Educating homeowners is the first step in promoting a shared responsibility. Part of the educational process is defining the hazard and risks both at the mid level and parcel level. A matrix of common fire mitigation needs is displayed. See Appendix D for a complete listing of the survey questions and answers.

RECOMMENDATIONS

Of the 444 homes were surveyed:

Access

197 homes surveyed do not have reflective, visible address signage.

- Facilitate address signage for all 197 and all new home construction.

12 homes surveyed did not have adequate vertical clearance for fire apparatus.

- Identify these homes and recommend minimum clearance be established.

- This can be a simple mitigation effort to ensure adequate access.

185 homes surveyed have a gated access

- Notify home owners of the delay that locked gates may impose on structure protection.

88 homes surveyed do not have adequate Fire Department turnarounds.

- Provide these homeowners with the turnaround specifications in Appendix C
- Inform homeowners of the value of a turnaround from both a suppression and safety perspective.

2 homes surveyed have wood roofs

- Inform the homeowners to contact their insurance companies for cost share assistance on replacement costs.

165 homes surveyed have vegetation either overhanging or within 5 feet of the home

- Facilitate community wide limbing and chipping programs in these areas.

203 homes surveyed have non-conforming defensible space

53 homes surveyed have no defensible space

- Focus initial efforts on the 53 homes with no defensible space
- Continue the defensible space program in cooperation with the local Fire Department
- Assist homeowners with on site recommendations for defensible space.

Utilize RedZone software and neighborhood public meetings to determine common mitigation requirements for the community

- It is often possible to obtain discounts for volume efforts.
- Facilitate neighborhood fuels reduction projects through:
  - Cost share grants
  - Utilization of cost share chipping programs.

FUELS MANAGEMENT FIRE MANAGEMENT AREA

Goals / Objectives of Fuels Management Projects are to:

- Improve the defensibility of communities from an encroaching wildfire.
- Allow for the use of prescribed fire into the SPRNCA through the pre-planning and establishment of control lines.

The recommended firebreaks and fuel break described graphically in the individual reports represents protection for the most vulnerable communities in the study area. One fire management strategy with firebreaks and fuel is to tie them into existing trails and roads wherever possible.

The BLM should coordinate with the citizens impacted by these projects. The BLM should foster and assist citizen efforts in coordination with these projects.

Fuel Models and Fire Behavior

Fire behavior modeling is done by generalizing fuel types found in the field into fuel model types. The area in and around SPRNCA are comprised several fuel models, each with its own characteristics. The Fuel Models used for this project were:

- Fuel Model 1 is short grass, less than 1 foot high. Fire occurs at the surface and moves rapidly through the cured grass and associated material.

- Fuel Model 3 is for tall grass, averaging 3 feet high, though considerable variation may occur. Fires in this fuel type is the most intense of the grass group and displays high rates of spread under the influence of wind. Wind may drive fire into the upper heights of the grass and across standing water.

- Fuel Model 5 is for continuous stands of low brush, with heights not exceeding six feet. Fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material.

- Fuel Model 6 represents dormant brush and hardwood slash, generally not exceeding 6 feet in height. Fires carry through the shrub layer where the foliage is more flammable than Fuel Model 5, but this requires moderate winds, greater than 8 miles per hour at midflame height. Fire will drop to the ground at low wind speeds or at openings in the stand.

- Fuel Model 8 is for closed timber litter, which is comprised mainly of needles, leaves, and occasionally twigs, with little undergrowth. Fires are generally slow-burning ground fires with low flame lengths, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up.

Behave model runs were completed using the following parameters:

Fuel Moisture by Fuel Type			Slope
10-hr Fuels	100-hr Fuels	Herbaceous	
5%	6%	100%	10%

Fuel models are a set of numbers that describe the fuel in terms that a fire spread model can use. It uses 7 characteristics to categorize them.

- Fuel Loading
- Size and Shape
- Compactness
- Horizontal Continuity
- Vertical Arrangement
- Moisture Content
- Chemical Content
- Description

The **BEHAVE** Fire Behavior Prediction and Fuel Modeling System was utilized to help determine the wildfire hazard for the SPRNCA Community. The system gathers available fire models into a system that is driven by direct user input. It has been used for a variety of applications including projection of an ongoing fire, prescribed fire planning, fuel hazard assessment, initial attack dispatch, fire prevention planning, and training. **BEHAVE** is run by user-supplied input. Requested values depend on the modeling choices made by the user. For example, fuel model, fuel moisture, wind speed and direction, terrain, and slope are used to calculate rate of spread, flame length, and intensity. Other outputs that can be derived from the model include:

- Surface fire spread, intensity, flame length

- Area and perimeter of a point source fire
- Spotting distance
- Probability of ignition
- Scorch height
- Tree mortality

The SPRNCA area is represented by several fuel models. Each is described below with a table showing a range of fire behavior based on the **BEHAVE** system.

FUEL MODEL 1 - Short Grass

Figure 12. Fuel Model 1 - Short Grass

Characteristics[1] --Grasslands and savanna are represented along with stubble, grass-tundra, and grass-shrub combinations.

Common Types / Species -- Annual and perennial grasses such as Lehman's Lovegrass, Spiny Aster, Tobosa are included in this fuel model.

Fire Behavior -- Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one-third of the area.

Table 3. Rate of spread in chains/hour (1 chain=66 ft) for Fuel Model 1

[1] Anderson, Hal. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. Gen. Tech. Rep. INT-122. Ogden , UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station 22 p. (NFES 1574).

		Mid-flame Wind Speed					
Fine Dead Fuel moisture %		2.0	4.0	6.0	8.0	10.0	12.0
	2.0	28.8	92.9	203.6	362.4	570.1	665.6
	4.0	22.0	71.1	155.7	277.0	345.1	345.1
	6.0	19.4	62.4	136.8	243.4	270.1	270.1
	8.0	16.7	53.9	118.1	198.7	198.7	198.7
	10.0	11..0	35.6	64.8	64.8	64.8	64.8

Table 4. Flame Length in Feet for Fuel Model 1

		Mid-flame Wind Speed					
Fine Dead Fuel moisture %		2.0	4.0	6.0	8.0	10.0	12.0
	2.0	3.0	5.1	7.3	9.6	11.8	12.7
	4.0	2.4	4.1	5.9	7.8	8.6	8.6
	6.0	2.2	3.8	5.5	7.1	7.5	7.5
	8.0	2.0	3.4	4.9	6.3	6.3	6.3
	10.0	1.4	2.4	3.2	3.2	3.2	3.2

FUEL MODEL 3 - Tall Grass

Figure 13. Fuel Model 3 - Tall Grass

Characteristics -- Stands are tall, averaging about 3 feet (1 m) but considerable variation may occur. Approximately one-third or more of the stand is considered dead or cured and maintains the fire.

Common Species / Species-- Various Tallgrass species such as Sacaton, Sacaton/Tobosa, and Johnson Grass.

Fire Behavior -- Fires in this fuel are the most intense of the grass group and display high rates of spread under the influence of wind. Wind may drive fire into the upper heights of the grass and across standing water.

Table 5. Rate of spread in chains/hour (1 chain=66 ft) for Fuel Model 3

		Mid-flame Wind Speed					
Fine Dead Fuel moisture %		2.0	4.0	6.0	8.0	10.0	12.0
	2.0	61.7	139.3	230.4	331.6	441.1	557.6
	4.0	48.6	109.7	181.5	261.2	347.4	439.2
	6.0	40.2	90.7	150.0	215.9	287.1	363
	8.0	34.8	78.6	130.0	187.1	248.9	314.7
	10.0	31.4	70.8	117.2	168.7	224.4	283.6

Slope 10%

Table 6. Flame Length in Feet for Fuel Model 3

		Mid-flame Wind Speed					
Fine Dead Fuel moisture %		2.0	4.0	6.0	8.0	10.0	12.0
	2.0	3.0	5.1	7.3	9.6	11.8	12.7
	4.0	2.4	4.1	5.9	7.8	8.6	8.6
	6.0	2.2	3.8	5.5	7.1	7.5	7.5
	8.0	2.0	3.4	4.9	6.3	6.3	6.3
	10.0	1.4	2.4	3.2	3.2	3.2	3.2

FUEL MODEL 5 - Low Brush

Figure 14. Fuel Model 5 – Low Brush

Characteristics -- This model consists of continuous stands of low brush. Generally, heights do not exceed six feet. The stands will have a grass or scattered grass understory. Usually shrubs are short and almost totally cover the area.

Common Types / Species -- Young, green stands with no dead wood would qualify: Mixed Forbs, Mixed Upland Scrub, and Whitethorn. Mountain grasses are also associated with this type.

Fire Behavior -- The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. Cured leaves retained on shrubs can cause greater intensities.

Table 7. Rate of spread in chains/hour (1 chain=66 ft) for Fuel Model 5

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	9.7	22.5	38.2	56.2	76.0	97.5
4.0	8.7	20.1	34.2	50.3	68.1	87.3
6.0	7.5	17.5	29.8	43.8	59.2	76.0
8.0	5.5	12.7	21.6	31.8	43.1	55.2
10.0	2.7	6.4	10.8	15.9	21.5	21.8
12.0	2.6	6.1	10.4	15.3	20.1	20.1

Table 8. Flame Length in Feet for Fuel Model 5

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	4.3	6.4	8.1	9.7	11.2	12.5
4.0	3.9	5.8	7.4	8.8	10.1	11.4
6.0	3.5	5.1	6.5	7.8	8.9	10.0
8.0	2.6	3.8	4.9	5.8	6.7	7.5
10.0	1.4	2.0	2.6	3.1	3.5	3.6
12.0	1.3	2.0	2.5	3.0	3.4	3.4

FUEL MODEL 6 - Dormant Brush, Hardwood Slash

Figure 15. Fuel Model 6 - Dormant brush, hardwood slash

Characteristics -- The shrubs are mature and usually do not exceed 6 feet in height. Additionally, fuel model 6 contains a dead vegetative component that contributes to its flammability.

Common Types/Species -- A broad range of shrub conditions is covered by this model. Fuel situations to be considered include Mesquite, Saltcedar, and mixed upland scrub. Even hardwood slash that has cured can be considered.

Fire Behavior -- Fires carry through the shrub layer where the foliage is more flammable than Fuel Model 5, but this requires moderate winds, greater than 8 miles per hour (13 km/h) at midflame height. Fire will drop to the ground at low wind speeds or at openings in the stand.

Table 9. Rate of spread in chains/hour (1 chain=66 ft) for Fuel Model 6

	Mid-flame Wind Speed					
Fine Dead Fuel moisture %	2.0	4.0	6.0	8.0	10.0	12.0
2.0	17.2	38.5	63.9	92.4	123.5	156.8
4.0	13.9	31.1	51.7	74.8	99.9	126.9
6.0	11.7	26.2	43.5	62.9	84.1	106.8
8.0	10.2	22.9	38.1	55.0	73.6	93.4
10.0	9.2	20.7	34.4	49.7	66.5	84.4
12.0	8.5	19.1	31.7	45.9	61.4	77.9

Table 10. Flame Length in Feet for Fuel Model 6

	Mid-flame Wind Speed					
Fine Dead Fuel moisture %	2.0	4.0	6.0	8.0	10.0	12.0
2.0	5.0	7.3	9.2	10.9	12.4	13.9
4.0	4.3	6.2	7.8	9.3	10.6	11.8
6.0	3.8	5.5	6.9	8.2	9.3	10.4
8.0	3.4	5.0	6.3	7.4	8.5	9.5
10.0	3.2	4.7	5.9	7.0	8.0	8.9
12.0	3.1	4.4	5.6	6.7	7.6	8.5

FUEL MODEL 8 - Closed timber litter

Figure 16. Fuel Model 8 - Closed Timber Litter

Characteristics -- Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand.

Common Types / Species -- Mature Mesquite, Cottonwood, and Willow

Fire Behavior -- Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do these fuels pose fire hazards.

Table 11. Rate of spread in chains/hour (1 chain=66 ft) for Fuel Model 8

	Mid-flame Wind Speed					
Fine Dead Fuel moisture %	2.0	4.0	6.0	8.0	10.0	12.0
2.0	1.1	2.3	3.9	5.7	7.8	10.1
4.0	0.9	1.9	3.2	4.7	6.4	6.9
6.0	0.7	1.6	2.6	3.9	4.9	4.9
8.0	0.6	1.4	2.3	3.4	3.8	3.8
10.0	0.6	1.2	2.0	3.0	3.1	3.1
12.0	0.5	1.1	1.8	2.7	2.7	2.7

Table 12. Flame Length in Feet for Fuel Model 8

	Mid-flame Wind Speed					
Fine Dead Fuel moisture %	2.0	4.0	6.0	8.0	10.0	12.0
2.0	0.9	1.3	1.7	2.0	2.3	2.6
4.0	0.8	1.1	1.4	1.7	2.0	2.0
6.0	0.7	1.0	1.2	1.5	1.7	1.7
8.0	0.6	0.9	1.1	1.3	1.4	1.4
10.0	0.6	0.8	1.0	1.2	1.3	1.3
12.0	0.6	0.8	1.0	1.2	1.3	1.3

PRESCRIBED-FIRE FIRE MANAGEMENT AREA (FMA)

Goals and Objectives of Prescribed Fire

- Improve ecological health and increase the vigor of the native species in the SPRNCA.
- Reduce fuel loading of critical boundary areas.
- Use prescribed fire as a valuable resource management tool.
- Provide fire training for firefighters and BLM staff.

Prescribed Fire Use

Livestock grazing, development and past land management decisions have significantly changed the fire return interval and the overall fuel profile of the area. Fire should be re-introduced as a natural process in the shrub and grasslands of the SPRNCA community to help maintain and restore native plant communities.

Under ideal conditions, grassland diversity is maintained by a fire interval of historically every 10-20 years, may need to initially start with a 6-10 year interval. Shrub species have varied fire intervals from 5-35 years. The health of these ecosystems has been declining for years due to fire suppression and competition from exotic grasses and forbs. Burning has a stimulating effect on the growth and competitive vigor of native grasses and shrubs. Plants in recently burned areas start growth earlier in the spring, develop faster, and produce more herbage than plants in unburned areas.

Prescribed burning has many benefits both ecological and economic; however, there are risks and costs involved. A good prescribed burn program should build on a foundation of safe and effective fire practices which help to build trust in the community. Smoke impacts to people, roads and homes must be considered.

There are many areas that would benefit from fire in the SPRNCA community. Specific burn plans should be developed on a case by case basis with priorities being set by the BLM and stakeholders.

LAND USE AND BUILDING CODES

There are many elements in a successful WUI program. An important and often overlooked element is land use regulation and building code establishment. The inclusion of a natural hazard element into the Cochise County Comprehensive Plan is recommended.

The purpose of a Natural Hazards Element is to avoid or reduce risk to an acceptable level which balances the cost of incorporating safety measures in planning and development actions with the benefit of protecting life and property. "Acceptable risk" is the level of

hazard below which no specific action by local government is deemed necessary, other than making the risk known. It is the standard around which a natural hazards element is designed.

A philosophical question which often results from discussions of planning for public safety is one of: "How much should a person be protected from his / her own actions?" It is perhaps reasonable to conclude that an individual does not warrant special protection from his or her own personal foolishness or ignorance. Unfortunately, personal safety issues often become public safety issues where natural hazards and the WUI are concerned.

Decision makers may be forced to utilize incomplete data at times, acting on projects without having detailed information on certain types of natural hazards. This is unavoidable, to a certain extent, pending the completion of more detailed research. Such research may never provide all the information needed though, and decision makers are forced to use the best information available, combined with common sense, to determine whether any given project remains within the realm of acceptable risk. It should be noted one of the goals of a natural hazards element indicates that the term "risk" relates to threats to either life or property. The finding that the level of risk associated with a given project is acceptable or unacceptable may be somewhat of a subjective evaluation of the decision makers.

The Natural Hazards Element is directly related to plan elements dealing with land use, environmental quality, and resource management. Its relationship to the *Land Use Code* and county building codes is critical; these codes should include measures to reduce the effects of natural hazards. This element is also related to the environmental resources, economy, transportation, recreation, solid waste, and public facilities and services portions of the comprehensive plan, in that the policies and strategies proposed (or the mitigating measures not taken) will have an impact upon land and financial resources with the county.

Goals:

- Inappropriate development in Wildfire Hazard areas should be reduced as much as possible or eliminated in order to minimize potential harm to life, health and property.
- Efforts to mitigate existing areas at risk to the impacts of wildfires should be made to minimize the potential for harm to life, health, and property.

RECOMMENDATIONS

- Cochise County should include a Wildfire Hazard/Natural Hazards element to the County Comprehensive plan.
- The County should ensure appropriate future development by

- Development / site plan reviews in areas identified to be at risk of wildfires. These reviews should address:
    - site location, building construction and design, landscaping / defensible space / fuel management, access and water availability.
    - These factors should be analyzed from the standpoint that wildfires may present a hazard to development and/or development may present an ignition hazard to the wildlands
- Adoption of model fire codes to ensure appropriate construction
    - NFPA 299, (Protection of Life and Property from Wildfire)
    - International Fire Code Institute (IFCI) Wildland Urban Interface Code.
    - NFPA 295 (Wildfire Control)
    - NFPA 291 (Recommended Practice for Fire Flow Testing and Marking of Hydrants)
    - NFPA 703 (Standard for Fire Retardant Impregnated Coatings for Building Materials)
    - NFPA 909 (Protection of Cultural Resources)
    - NFPA 1051 (Standard for Wildland Fire Fighter Professional Qualifications)
    - NFPA 1144 (Standard for Protection of Life and Property from Wildfire)
    - NFPA 1977 (Protective Clothing and Equipment for Wildland Fire Fighting)

Costs of Mitigation

The cost of performing mitigation work can vary by geographic location, type of terrain, vegetation, season, and the state of the local economy, which influences the hourly rates for labor and machines. Current information regarding treatment costs for a specific area may be obtained from the contracting officers for that region.

Given the variability of labor, equipment, operator skill, vegetation density, it is still possible to make some generalizations about fuels mitigation costs. Considering the types of vegetation and terrain, costs were developed for four methods of fuels reduction.

Roller chopping is frequently applied to mountain shrubs and pinon/juniper stands with stem diameters eight inches or less in diameter. It is very effective for knocking down brush and trees and chopping up the slash. Roller chopping can be done when the soil is firm and dry enough to support the heavy equipment. Roller chopping costs about $60-$80 per acre and can treat 13-20 acres per day.

The Hydro axe, also known as a Hydro mower, is typically a rubber-tired, articulated tractor with a mower/mulcher mounted on the front of the machine. The mower/mulcher is between 8 and 9 feet wide. The Hydro axe can navigate through stands in order to treat selected areas. The machine clips and mulches plant debris within 4 to 10 inches above the ground. Hydro-axing typically costs $70 per acre and can treat 6 to16 acres per day.

Mowing is typically done with a small farm tractor equipped with a flail mower such as a Brush Hog. Mowing is limited to areas that are relatively smooth and free from rocks projecting more than 4 to 6 inches above the ground. The effectiveness of mowing is somewhat dependant on the operators ability to maneuver around obstacles without damaging the equipment. Mowing costs typically vary between $30-$60 acre.

Prescribed fire costs can range greatly, from $20-$1,200 per acre. Costs are difficult to predict for a generic site because burning is dependent on many factors, such as proximity to structures, access to the site, fuel type and the total acreage.

Other Reports From This Project

A total of seven reports were produced for this project. They are available from the Tucson Field Office, or are available on-line at:

http://azwww.az.blm.gov/azso.htm

http://azwww.az.blm.gov/tfo/index.htm

Appendix A: Individual Structure Wildfire Hazard & Risk Evaluation Questionnaire

Access

Is the structure address clearly visible from the street? (Visible Address)

[0] Yes

[1] No

What is the grade of the driveway? (Driveway Grade)

[0] Flat (0% - 5%)

[1] Low (6% - 8%)

[2] Moderate (9% - 12%)

[3] Steep (> 12%)

What is the driveway length? (Driveway Length)

[0] < 50 feet

[1] 51 to 100 feet

[2] 101 feet to 500 feet

[3] 501 feet to 1000 feet

[4] >1001 feet

What is the width of the driveway? (Driveway Width)

[0] Not applicable (< 50 feet)

[1] 2 Engines (> 22 feet)

[2] Pullouts Exist (min 22x30 feet)

[3] 1 Engine (8 -22 feet)

[4] Inaccessible

Is there a minimum 15-foot vertical clearance for the driveway? (Vertical Clearance), Vegetation or Manmade Obstructions

[0] Yes

[1] No

Is access to the home gated? (Gated Access)

[0] No

[1] Yes

Is there a turnaround for an engine? (Turnaround)

[0] Yes

[1] No

Topography

Predominant aspect? (Aspect)

[0] Flat (0-5%)

[1] North (NW <- N -> NE)

[2] East (NE <- E -> SE)

[3] South (SE <- S -> SW)

[4] West (SW <- W -> NW)

Overall slope for the area within 150 feet of house? (Overall Slope)

[0] Flat (< 8%)

[1] Low (8% to 20%)

[2] Moderate (21% to 30%)
[3] High (31% to 75%)
[4] Extreme (> 75%)

Distance between structure and identified dangerous topography? (Dangerous Topo)

Chimney, V-canyon, Saddle or Ridge Top

Not Assessed
[0] Not Applicable
[1] > 500 Ft
[2] > 100 Ft to <500 Ft
[3] > 30 Ft to <100 Ft
[4] < 30 Ft

Fuel Type

Predominant background FUEL TYPE in the neighborhood? (Fuel Type)

[
0] Non-Combustible
[1] Grass (FM1)
[2] Grass w/ downed Stem wood (FM2)
[3] Tall Grass (FM3)
[4] Shrub (FM4)
[5] Shrub (FM5)
[6] Shrub (FM6)
[7] Litter (FM7)
[8] Litter (FM8)
[9] Litter (FM9)
[10] Litter (FM10)
[11] Slash (FM11)
[12] Slash (FM12)
[13] Slash (FM13)

Construction

What type of roofing material? (Roofing Material)

[0] Tile
[1] Metal
[2] Asphalt
[3] Wood

What is the siding material? (Siding Material)

[0] Non-flammable
[1] Mixed Stone and Wood
[2] Log (6" tip minimum)
[3] Wood Sheeting

Balconies or porches? (Balconies)

[0] Not Present
[1] Enclosed to grade
[2] Not Enclosed to grade

Eaves? (Eaves)

[0] Not Present
[1] Enclosed
[2] Not Enclosed

Indoor sprinkler system? (Indoor Sprinkler)

[0] Yes
[1] No

Proximity of propane tank to the house? (Propane Proximity)

[0] Not applicable
[1] Down hill more than 50 ft
[2] Down hill less than 50 feet
[3] Up hill / even more than 50 ft
[4] Up hill / even less than 50 ft

Location of propane tank? (Propane Location)

[0] A Side (front)
[1] B Side (left)
[2] C Side (rear)
[3] D Side (right)

Location of the electric shut off panel? (Service panel)

[0] A Side (front)
[1] B Side (left)
[2] C Side (rear)
[3] D Side (right)

Location of utility line within 50 ft. of structure? (Utility Line)

[0] Below Ground
[1] Above Ground

Onsite Fuel

Combustible materials against house? (Combustible Material)

[0] None Present
[1] Light Flashy Vegetation
[2] Shrubs
[3] Trees
[4] Firewood
[5] Trash
[6] Multiple Items above

Vegetation NEAR ROOF? (Veg/Roof)

[0] Not Applicable
[1] Branches/limbs Within 5 Feet
[2] Overhanging Branches/Limbs
[3] Leaf & needles on roof/gutters

Vegetation type and density within 200 feet of structure? (Veg/Type), Including deadwood

[0] Not Applicable
[1] GRASS or GRASS with aspen trees
[2] GRASS with scattered trees or brush
[3] Willows
[4] Thinned CONIFERS (10 foot spacing)
[5] OakBrush / SageBrush / Other Non-Riparian Brush
[6] Moderately Dense CONIFERS or BRUSH
[7] Dense Continuous CONIFERS &/or Thick BRUSH

Fuel Continuity Break to the structure? (Continuity)

[0] > 200 feet

[1] > 30 feet, but < 60 feet

[2] > 60 feet, but < 200 feet

[3] < 30 ft WITH defensible space

[4] < 30 ft WITHOUT d-space

Describe the Defensible Space? (Defensible Space)

[0] Conforming

[1] Non-Conforming

[2] None

Onsite Water

Primary on-site water source for firefighters? (Onsite Water)

[0] Hydrant (pressurized)

[1] Stream (w/ dry hydrant)

[2] Cistern

[3] Pond

[4] Swimming Pool

[5] None

Is the on-site water source seasonal? (Seasonal Water Source)

[0] No

[1] Yes

Notes:

Specific items the homeowner can mitigate? (Mitigation)

Gutters

Woodpile

D-Space

Address Singing

(\ for none)

Additional Notes (Notes)

Photo number

Additional Structures

Helispots

(\ for none)

Latitude and longitude coordinates of the residence?

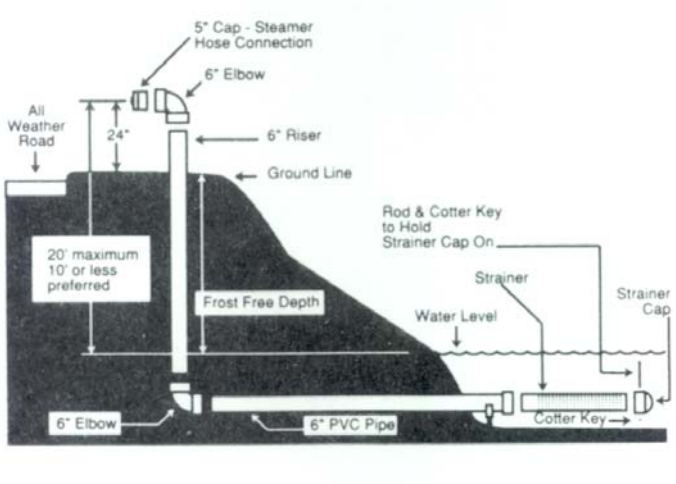
Appendix B: Dry Hydrant Concept

A dry hydrant is a non-pressurized pipe system permanently installed in existing lakes, ponds, and streams that provides means of suction supply of water to the tank truck. The concept is not new. Many fire departments have successfully used dry hydrants for a number of years, although its use is not wide spread.

In many rural areas, a lack of water mains and domestic fire hydrants can sometimes impair a fire department's ability to do its job quickly and efficiently. Tanker trucks must be used to carry large amounts of water to the fire scene. The success of the operation hinges on the distance the trucks must travel to water "fill-up" points around the county. Unfortunately, the fill-up points are often a long distance from the fire, and fire-fighters are unable to retain an uninterrupted water supply at the scene in many cases.

Some counties have begun to take advantage of "natural water sources" for fire-fighting. The installation of a non-pressurized pipe system into these water sources provides a ready means of a suction-supply of water to tank trucks. The dry hydrant system gives the trucks access to the ponds and streams from the main road. As in the drawing, one end of the dry hydrant sticks out of the ground to give tankers a hose connection, and the other end is a strainer submerged in the pond or stream to draw water directly through the system.

The dry hydrant can be made of any hard, permanent material (steel, iron); however, PVC (polyvinyl chloride) is becoming commonly used due to price, accessibility and low friction loss-performance. The other elements of the system include an intake filtration section, hydrant head with suction screen and cap. All component parts should be expertly engineered and built for trouble-free service.



Drawing 1- **Enlarged view of dry hydrant construction**

Benefits

A properly installed dry hydrant allows natural, unprocessed water to be used for road maintenance and fire protection if appropriate water-use applications are obtained. Water use for suppression is considered a "non-consumptive use in most states. Utilizing unprocessed water allows small towns to better use their limited water storage for drinking water. A well planned and designed dry hydrant water delivery system can improve fire fighting capability of rural fire departments, save fuel and reduce the cost of operations.

An additional benefit to citizens where dry hydrants have been properly used is in the reduction of the fire classification for fire insurance. For example, when the Forsyth County, Georgia volunteer fire department, with proper training and equipment, used the dry hydrant water delivery system, county homeowners saw their insurance rates drop by 49 percent. For an $85,000 home, this means $200 savings per year on homeowner's insurance.

Water is a key ingredient for proper road maintenance. Research has shown that an automobile traveling on a well-compacted gravel road, as opposed to a loose road surface, will use 11 to 12 percent less fuel.

Improve Fire Protection

The recommended distance between dry hydrants is one every 3 square miles. This would ensure that fire tankers would travel no more than three miles to a fill-up point. And since the fill-up through the system usually takes about two minutes to complete, there could be an uninterrupted water supply and better fire control.

Lower Insurance Rates

Fire insurance premiums for each area are based on a classification by the Insurance Service Organization (ISO). The classification depends on each area's ability to fight fires.

Areas with no fire departments are given a class 10 rating. As the fire-fighting capability increases, the rating decreases. This can be accomplished through higher training levels, better equipment, etc. If a fire department can demonstrate the ability to keep 250 gallons of water per minute for two hours at a fire scene, the area's fire rating could potentially decrease to a six or seven. The ISO, however, makes the final determination regarding the rate.

With a dry hydrant system, this goal can be easily achieved. A fire rating decrease from a nine to a seven can often reduce insurance rates by 45 to 50 percent.

Conserve Treated Water Supply

Dry hydrants are installed in untreated water supplies, which means that fire departments do not have to use the treated water from towns in the county. As water becomes more scarce, the treated water would be available to the citizens for drinking.

Conserve Energy

Since tanker trucks have less travel time between fill-up points, they would save fuel. The overall operating costs of the fire department would be lessened by the use of dry hydrants.

Promote Economic Development

With lower insurance rates and higher fire-fighting capability, the area would be more attractive to developers and homeowners.

Improve Road Maintenance

A large amount of water is usually needed for the installation of the base on gravel roads. The water allows for better compacting of the road, which can sometimes improve gas mileage for cars that travel on it.

Pre-planning

A number of pre-planning activities should take place by local government or community fire departments as a prerequisite to the consideration of dry hydrants.

A master fire plan should be developed stating goals and objectives for rural fire protection. The plan should serve as the guide for organization, equipment, training, and water supply needs to reach the level of fire protection desired.

Plans should include, but are not limited to:

a. Equipment (large-chassis, pumpers, tankers, ladder units, other rolling stock)

b. Equipment (support, accessory, and personnel)

c. Staffing levels

d. Training, equipment and facilities

e. Building(s) - new, renovation, addition

f. Inspections - commercial building, residential (all types), hospitals, schools, homes for the elderly, fire hydrants and water supply points

g. I and E - information, public education, fire prevention

h. Water supply improvements for fire protection

Appendix C: Access Specifications and Designs

Emergency Access and Water Supply

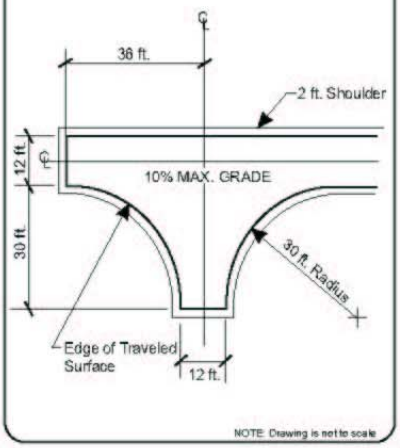
Emergency personnel try their best to respond to calls in a timely manner, often while negotiating difficult terrain. Planning for access by emergency equipment allows for a more efficient response, improving safety for homeowners and their families, as well as the firefighters and emergency medical technicians that may arrive on the scene. This is especially important in rural areas where response times may be considerably longer than in cities, where emergency services are close by.

ACCESS GUIDELINES

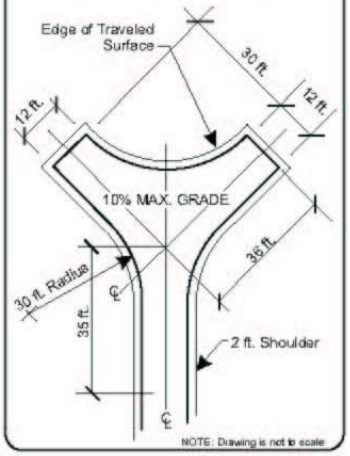
Driveway Turn-Arounds

Driveway turn-arounds may be required as part of a Site Plan Review for driveways that are 150 feet or more in drivable length from the public or private road. Turn-arounds, unobstructed by parking, are designed and constructed to allow for safe reversal of direction by emergency equipment. The "Y" and "Hammerhead" turn-arounds shown below are preferred because they provide the necessary access while minimizing disturbance to the site.

HAMMERHEAD TURNAROUND



Y CONFIGURATION



BRIDGE LOAD LIMITS

The load limits for a bridge shall be posted at both entrances of the bridge.

DRIVEWAY WIDTH & HEIGHT

Design your driveway to have an unobstructed vertical clearance of 13 feet, 6 inches. You may need to limb trees or bury utility lines to provide necessary clearance.

Design your driveway with a 12 foot wide driveable surface and a 14 foot clearance of obstructions.

ADDRESS SIGNS

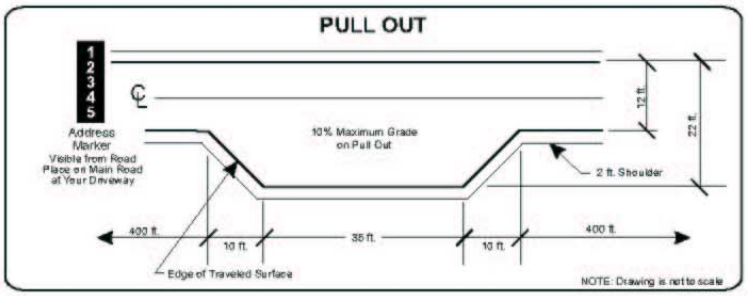
All buildings should have a permanently posted, reflective address sign. This sign should be placed and permanently maintained at each driveway entrance.The address sign must be visible from both directions of travel.

For more information please contact the Anchor Point Group at 303-665-3473.

Driveway Pull-Outs

Driveway pull-outs are designed with sufficient length and width to allow emergency vehicles to pass one another during emergency operations. These features should be placed at 400 foot intervals along the driveway. The location of the pull-out(s) can be modified to accommodate physical barriers such as rock outcrops, wetlands, and other features.

PULL OUT



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Appendix D: Wildfire Hazard - Values at Risk Evaluation of the Entire San Pedro River Study Area.

(including the communities of: Babocamari, Hereford, Lewis Springs, Palominas, Rural Area #1, 2 & 3, St. David and Tombstone).

Wildfire Hazard - Values at Risk Evaluation of the Entire San Pedro River Study Area

HOME SURVEY QUESTIONS AND ANSWERS			
	Homes		Homes
VISIBLE ADDRESS:		**DANGEROUS TOPOGRAPHY:**	
Not Present	100	Not Applicable	364
Present, Not Reflective	97	< 150 feet	49
Present and Reflective	245	Not Assessed	31
Unanswered	2	>100 ft to <500 ft	
		>30 ft to <100 ft	
ROOFING MATERIAL:		>500 ft	
Asphalt	281		
Metal	138	**UTILITY LINE:**	
Wood	2	Below Ground	69
Tile	16	Above Ground	202
Unanswered	7	Unanswered	11
		One Above / One Below	162
SIDING MATERIAL:			
Non-Flammable	264	**COMBUSTIBLE MATERIAL:**	
Wood Sheathing	157	None Present	
Log (6" tip minimum)		Shrubs	
Mixed Stone and Wood	16	Light Flashy Vegetation	
Unanswered	7	Multiple Items Above	
		Trees	
EAVES:		Trash	
Enclosed	208		
Not Present	142	**VEGETATION NEAR ROOF:**	
Not Enclosed	87	Not Applicable	276
Unanswered	7	Branches / Limbs within 5 feet	86
		Unanswered	3
DRIVEWAY GRADE:		Overhanging Branches / Limbs	79
Flat (0% - 5%)	395	Leaf & Needles on Roof / Gutters	
Low (6% - 8%)	29		
Moderate (9% - 12%)	10	**ROAD WIDTH:**	
Steep (>12%)	7	Less than 20'	229
Unanswered	3	Between 20' and 24'	104
		Greater than 24 feet wide	109
DRIVEWAY LENGTH:			
<300 ft.	358	**FUEL TYPE:**	
>300 ft.	83	Grass w / downed Stem Wood (FM2)	
Unanswered	3	Litter (FM8)	
		Grass (FM1)	
TURNAROUND:		Unanswered	2
Yes	353	Litter (FM7)	
No	88	Tall Grass (FM3)	
Unanswered	3	Shrub (FM4)	
		Litter (FM9)	
VERTICAL CLEARANCE:		Shrub (FM5)	
Yes	430	Light:	202
No	12	Moderate:	179
Unanswered	2	Heavy:	61

GATED ACCESS:	
Yes	185
No	257
Unanswered	12
ASPECT:	
East (NE <-E-> SE)	9
South (SE <-S-> SW)	28
North (NW <-N-> NE)	28
West (SW <-W-> NW)	6
Flat (0% - 5%)	370
Unanswered	3
SEASONAL WATER SOURCES:	
No	144
Yes	6
Unanswered	261
Unknown	33
ON-SITE WATER:	
None	393
Cistern	4
Unanswered	4
Pond	10
Swimming Pool	18
Stream (w / dry hydrant)	14
Pressurized Hydrant	1
OVERALL SLOPE:	
Low (8% to 20%)	48
Flat (<8%)	372
High (31% to 75%)	3
Moderate (21% to 30%)	18
Extreme (>75%)	
Unanswered	3
VEGETATION / TYPE:	
GRASS with scattered trees or brush	
Moderately Dense CONIFERS or BRUSH	
GRASS or GRASS with aspen trees	
Willows	
Dense Continuous CONIFERS and / or Thick BRUSH	
Thinned CONIFERS (10 feet spacing)	
BALCONIES:	
Not Enclosed to Grade	
Enclosed to Grade	
Not Present	

FUEL CONTINUITY:	
> 30 feet but < 60 feet	
< 30 feet WITHOUT defensible space	
>200 feet	
>60 feet but <200 feet	
< 30 feet WITH defensible space	
DEFENSIBLE SPACE:	
Non-Conforming	203
None	53
Conforming	184
Unanswered	4
INGRESS / EGRESS:	
One Road In / Out	332
Two or more roads in / out	110
Unanswered	2
PROPANE PROXIMITY:	
More than 50 feet downhill	
less than 50 feet downhill	
less than 50 feet uphill / even	
more than 50 feet uphill / even	
Not Applicable	
PROPANE LOCATION:	
D Side (right)	
C Side (rear)	
A Side (front)	
B Side (left)	
SERVICE PANEL:	
C Side (rear)	
A Side (front)	
D Side (right)	
B Side (left)	
DRIVEWAY WIDTH:	
1 Engine (8 - 22 feet)	248
Not Applicable (<50ft)	145
Inaccessible	1
2 Engines (>22ft)	41
Pullouts Exist (min 22x30 ft)	7
Unanswered	2

Appendix E: Educational Resources

FIREWISE INFORMATION AND WEB SITES:

Firewise Communities/USA national recognition program,
http://www/Firewise.org/USA

The FireFree Program, sponsored by SAFECO Corporation, Wildfire Defense - Get in the Zone, Reduce Your Risk of Wildfire pamphlet
http://www.Safeco.com/Safeco/about/giving/firefree.org

Living with Fire - A Homeowners Guide. A 12-page tabloid, which is produced regionally by U.S. Dept. of Interior agencies (Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, National Park Service), USDA Forest Service, and state land departments. This is one of the most detailed pieces of Firewise information for landowners to reference when creating survivable space around their homes.
http://www.or.blm.gov/nwfire/docs/Livingwithfire.pdf

Fire Information Clearinghouse web site from the San Juan Public Lands Center:
www.SouthwestColoradoFires.org

ARIZONA WILDFIRE AND THE ENVIRONMENT SERIES:

Firewise publications from the University of Arizona Forest Home Fire Safety; Fire-Resistant Landscaping; Creating Wildfire-Defensible Spaces for your Home and Property. Homeowners' Inside and Out Wildfire Checklist; Firewise Plant Materials for 3000 Feet and Higher Elevations, Soil Erosion Control After a Wildfire; Recovering from Wildfire; A Guide for Arizona's Forest Owners; Wildfire Hazard Severity Rating Checklist for Arizona homes and Communities.
http://www.cals.arizona.edu. or
http://cals.arizona.edu/education/firewise/

OTHER:

Federal Emergency Management Agency State Hazard Mitigation Officers
http://www.floods.org/shmos.htm

National Fire Plan
http://www.fireplan.gov/community_assist.crm

National Fire Protection Association - International NFPA 299 Standard for (Protection of Life and Property from Wildfire)

NFPA 295 (Wildfire Control)
NFPA 291 (Recommended Practice for Fire Flow Testing and Marking of Hydrants)
NFPA 703 (Standard for Fire Retardant Impregnated Coatings for Building Materials)
NFPA 909 (Protection of Cultural Resources)
NFPA 1051 (Standard for Wildland Fire Fighter Professional Qualifications)
NFPA 1144 (Standard for Protection of Life and Property from Wildfire)
NFPA 1977 (Protective Clothing and Equipment for Wildland Fire Fighting)
www.NFPA.org

National Fire Lab
http://www.firelab.org/fbp/fbresearch/WUI/home.htm

Protect Your Home from Wildfire. Publications to help assist you with wildfire prevention. Colorado State Forest Service.
http://www.colostate.edu/Depts/CSFS/homefire.html

US Fire Administration, FEMA, US Department of Homeland Security www.usfa.fema.gov
www.fema.gov/regions/viii/fires/shtm
www.fema.gov/kidswldfire

Fire Education Materials
www.symbols.gov

National Interagency Fire Center, NPS fire site
www.NIFC.nps.gov/fire

PBS NOVA - "Fire Wars"
www.PBS.org/wgbh/nova/fire/

PAMPHLETS

Saving Homes from Wildfires: Regulating the Home Ignition Zone, by the American Planning Association (APA). This May 2001 issue of the APA's Zoning News examines the wildfire threat to the Wildland Urban Interface zone, and shows how development codes can be used to save residential areas.

BOOKS

Everyone's Responsibility: Fire Protection in the Wildland Urban Interface , NFPA, 1994
This National Fire Protection Association book shows how three communities dealt with interface problems.

Firewise Construction Design and Materials
Publication sponsored by the Colorado State Forest Service (CSFS) and the Federal

Emergency Management Agency (FEMA). This booklet is 38 pages of detailed home construction ideas to make a home Firewise. Various other publications are available from the CSFS on Wildland Urban Interface issues.

Is Your Home Protected from Wildfire Disaster?, A Homeowner's Guide to Wildfire Retrofit, IBHS, 2001 This Institute for Business and Home Safety book provides homeowners with guidance on way to retrofit and build homes to reduce losses from wildfire damage.

Stephen Bridge Road Fire Case Study, NFPA, 1991 Provides information to assist planners, local officials, fire service personnel and homeowners.

Wildland Fire - Communicator's Guide, for fire personnel, teachers, community leaders and media representatives.

CD ROM

Arizona Firewise Communities Educator's Workshop, Payson, AZ, Feb. 18-19, 2003.

Burning Issues, Florida State University and the USDI Bureau of Land Management, 2000. Interactive multimedia program for middle and high school students to learn about the role of fire in the ecosystems and the use of fire managing rural areas.

Wildland Fire Communicator's Guide - This interactive CD-Rom compliments the book.

OTHER PUBLICATIONS

It Can't Happen to My Home!, Are You Sure?
A publication by the USDA Forest Service, Southwestern Region, 12 page document.

Wildfire Strikes Home! It Could Happen to You, How to Protect Your Home! / Homeowners Handbook, from the USDI Bureau of Land Management, the USDA Forest Service and state foresters (publications: NFES 92075 and NFES 92074).

Appendix F: Potential Sources Of State And Federal Funding And Grants

GRANT WEB SITES

Southwest Area Forest, Fire and Community Assistance Grants - web site that lists grants that are available to communities to reduce the risk of wildfires in the urban interface.
http://www.SouthwestAreaGrants.org/

U.S. Fire Administration - Assistance to Firefighters Grant Program
http://www.usfa.fema.gove/dhtml/inside-usfa/grants.cfm

National Association of State Foresters Listing of Grant Sources and Appropriations
http://www/stateforesters.org/S&PF/FY_2002.html

Stewardship and Landowner Assistance - Financial Assistance Programs
http://www.na.fs.fed.us/spfo/stewardship/financial.htm

The Fire Safe Council
www.FireSafeCouncil.org

Pre-Disaster Mitigation Program
http://www/cfda/gov/public/viewprog.asp?progid=1606

Firewise
http://www.firewise.org/usa/funding.htm

Environmental Protection Agency
http://cfpub.epa.gov/fedfund/

Appendix G: BLM, Safford/Tucson Fire Management Zone Video Library

FIREWISE

1) NFES 1271, Developing a Cooperative Approach to Wildfire Protection, ’97, 24 min.

2) NFES 2103, Firefighter Safety in the Wildland Urban Interface (27m), Firefighter Safety (17m), Safety Checkout (10m), 90’s, 54 min.

3) NFES 2182, Wildfire Control: An Introduction for Rural and Volunteer Fire Departments, ’91, 27 min.

4) NFES 2186, The Meeting: Fire Protection Planning in the WUI, ’91, 32 min.

5) NFES 2376, Focus on Wildland Fire, Prevention: Profiling Four Programs That Really Work, ’94, 21 min.

6) NFES 2411, Firewise Landscaping Part I: Overview, ’93, 13 min.

7) NFES 2412, Firewise Landscaping Part II: Design and Installation, ’94, 16 min.

8) NFES 2413, Firewise Landscaping Part III: Maintenance, ’94, 9 min.

9) NFES 2414, Firewise Landscaping Part III: Maintenance (Spanish Version), ’94, 10 min.

10) NFES 2509, One Step Beyond, ’96, 17 min.

11) NFES 2533, Building a Firewise Home, ’97, 20 min.

12) NFES 2534, Making Your Home Firewise, ’97, 23 min.

13) NFPA Broadcast, Protecting Your Home Against Wildfire, 4/88, 19 min.

14) NFPA, Preventing Home Ignitions, 1/02, 19 min.

15) CSFS, Are you Firewise?, 2000, 11 min.

16) CDF, Fire Safe Inside and Out, 90’s, 25min.

17) Fire Safe Council and CA Interagency Prevention Committee, Fire Safe Landscaping, PSA’s, 90’s, est. 15 min.

18) Forest Service, Protecting Your Home From Wildfire, 00's, 26 min.

19) Forest Service Fire Science Lab, Preventing Home Ignitions, 00's, 19 min.

20) Firewise Communities, Introducing Firewise Communities Workshop and Wildfire! Preventing Home Ignitions, 00's, 25 min

21) Combo Pack, Creating Fire Resistant Environments (14m), Fire Protection Planning: The Meeting (32m), Protecting Your Home Against Wildfire (17m), 00's, 63 min.

22) Firewise Communities/USA, A Project of the National WUI Fire Program, 16 min.

FIRE FOR RESOURCE BENEFIT

23) Utah State Extension, Noxious Weeds: A Biological Wildfire, Applying Fundamentals of Wildfire Management to Improve Noxious Weed Control, 11/96, 15min.

24) BLM Prescribed Fire, 3/98, 12 min.

WILDLAND FIREFIGHTING

1) Firefighter Safety, Discussion Guide, '95, 6 min.

2) Managing Wildland Fire Teleconference, est.>1 hour

Appendix H: Fire Condition Classes

BACKGROUND

The condition class concept was most recently described by Hardy et al. (2001) and Schmidt et al. (2002). These descriptions are based upon the "relative risk of losing key ecosystem components". In certain cases, condition classes can be assigned when ecosystems have crossed ecological thresholds. For the purposes of condition class description, ecological risks are determined by contrasting current with historical conditions. Condition classes are then described qualitatively in terms of alteration from the historical range and risks associated with those departures.

The condition class concept helps describe alterations in key ecosystem components such as species composition, structural stage, stand age, canopy closure, and fuel loadings. These alterations may be caused by fire suppression, timber harvest, livestock grazing, exotic plant species, insects/disease, and other disturbances.

An interagency working group is completing a Condition Class Guidebook, which will provide worksheets and assist field units to accurately assign condition classes at multiple scales. Until the guidebook is completed, Field Units should utilize the following definitions synthesized from the Cohesive Fuels Strategy (July 2002) and Coarse-Scale Spatial Data for Wildland Fire and Fuel Management (April 2002).

CONDITION CLASS DEFINITIONS

Condition Class 1: Fire regimes are within an historical range, and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within an historical range. Fires burning in CC1 lands pose little risk to the ecosystem and have positive effects to biodiversity, soil productivity, and hydrologic processes.

Example of typical management: Historical fire regime is replicated through periodic application of prescribed fire or through fire use.

Condition Class 2: Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). This results in moderate changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range. Wildland fires burning in CC2 lands can have moderately negative impacts to species composition, soil conditions, and hydrological processes.

Example of typical management: Moderate levels of restoration treatments are required, such as a combination of prescribed fire with mechanical/hand treatment.

Condition Class 3: Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical

frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range. Wildland fires burning in CC3 lands may eliminate desired ecosystem components, exacerbate the spread of unwanted non-native species, and result in dramatically different ecological effects compared to reference conditions.

Example of typical management: High levels of restoration treatments, such as mechanical treatments, are required before fire can be used to restore desired ecosystem function. Intensive efforts, which may include seeding, herbicide application, biomass removal, and other types of rehabilitation, are required for lands in condition class 3.

FIRE REGIME DEFINITIONS

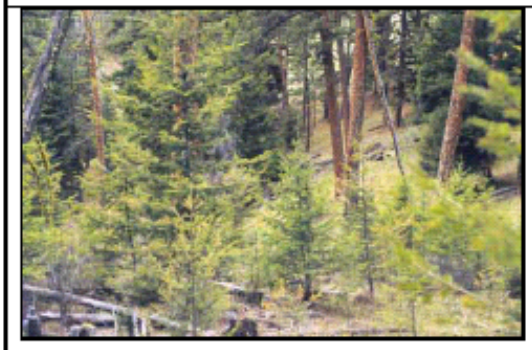
The fire regime concept is used to characterize the personality of a fire in a given vegetation type -- how often it visits the landscape, the type of pattern created, and the ecological effects. The following natural fire regimes are arranged along a temporal gradient, from the most frequent to the least frequent fire return interval.

REGIME	FIRE FREQUENCY	FIRE EFFECT TO DOMINANT ABOVE GROUND VEGETATION	REPRESENTATIVE ECOSYSTEM
Fire Regime I	0-35 years	Low severity	Dry pine and oak forests, Pinyon-juniper forests
Fire Regime II	0-35 years	Stand replacement	Grasslands, many shrub communities
Fire Regime III	35-100+ years	Mixed severity	Shrublands, mixed conifer forests
Fire Regime IV	35-100+ years	Stand replacement	Certain lodgepole pine, dry Douglas-fir forests
Fire Regime V	200+ years	Stand replacement	High elevation whitebark pine, spruce-fir, and Pacific coastal forests

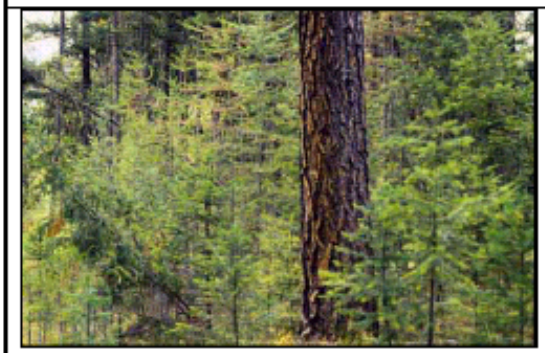
Photographic examples of Fire Condition Classes (USDI, 2003).

Fire Condition Class 1


Fire Condition Class 2




Fire Condition Class 3




REFERENCES

USDI, Office of the Assistant Secretary, Policy, Management and Budget. Memo from the Assistant Secretary to the Directors of the Bureau of Land Management, the Fish and Wildlife Service, the National Park Service, and the Deputy Commissioner of the Bureau of Indian Affairs, regarding "Determining Fire Class Conditions." Dated February 21, 2003.

OTHER REFERENCES:

Schmidt, Kirsten M., Menakis, James P., Hardy, Colin C., Hann, Wendel H., and Bunnell, David L. 2002. Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management. Rocky Mountain Research Station, General Technical Report GTR-RMRS-87. 41 p.

USDI and USDA Forest Service. 2002. Restoring Fire-Adapted Ecosystems On Federal Lands: A Cohesive Fuel Treatment Strategy For Protection People And Sustaining Natural Resources.

Appendix I: Fuels Model Conversion

Fuel Models and Fire Behavior

Fuel models are a set of numbers that describe the fuel in terms that a fire spread model can use. It uses 7 characteristics to categorize them.

- Fuel Loading
- Size and Shape
- Compactness
- Horizontal Continuity
- Vertical Arrangement
- Moisture Content
- Chemical Content
- Description

There are 13 fuel models that are used to represent the entire United States. While many fuel types fall into these models, there are many more that do not. However, the critical components can be matched as closely as possible to fit into one of the models. The local area should then compare the outputs of BEHAVE to actual fire behavior observed in the field and then adjust accordingly. Selection of fuel models is subjective as they can be delineated at different scales and many are related to height and % cover, both of which vary throughout a given unit, also there are seasonal changes that affect the typing. The evaluators experience and accuracy in estimating these units varies as well.

The **BEHAVE** Fire Behavior Prediction and Fuel Modeling System was utilized to help determine the wildfire hazard for this area. The system gathers available fire models into a system that is driven by direct user input. It has been used for a variety of applications including projection of an ongoing fire, prescribed fire planning, fuel hazard assessment, initial attack dispatch, fire prevention planning, and training. Requested values depend on the modeling choices made by the user. For example, fuel model, fuel moisture, wind speed and direction, terrain, and slope are used to calculate rate of spread, flame length, and intensity. Other outputs that can be derived from the model include:

- Surface fire spread, intensity, flame length
- Area and perimeter of a point source fire
- Spotting distance
- Probability of ignition
- Scorch height

- Tree mortality

Fuel Model Conversion

COVER	CANOPY	HEIGHT	ALLIANCE	Fuel Model typed by AP
Herbaceous	81-100	.1-5	Lehman's Lovegrass	1
Herbaceous	11-25	.1-5	Mixed Graminoids	1
Herbaceous	26-60	.1-5	Mixed Graminoids	1
Herbaceous	61-80	.1-5	Mixed Graminoids	1
Herbaceous	81-100	.1-5	Mixed Graminoids	1
Herbaceous	1-10	.1-5	Mixed Graminoids	1
Shrubland	11-25	.1-5	Mixed Graminoids	1
Shrubland	26-60	.1-5	Mixed Grass-Scrub	1
Shrubland	11-25	.1-5	Spiny Aster	1
Shrubland	26-60	.1-5	Spiny Aster	1
Shrubland	61-80	.1-5	Spiny Aster	1
Shrubland	81-100	.1-5	Spiny Aster	1
Herbaceous	61-80	.1-5	Tobosa	1
Herbaceous	81-100	.1-5	Tobosa	1
Shrubland	26-60	.1-5	Desert Willow/Rabbitbrush	2
Shrubland	26-60	.1-5	Desert Willow/Rabbitbrush	2
Shrubland	26-60	.1-5	Mesquite w/grass	2
Shrubland	61-80	.1-5	Mesquite w/Grass	2
Shrubland	81-100	.1-5	Mesquite w/grass	2
Herbaceous	11-25	.1-5	Mixed Grass-Scrub	2
Herbaceous	26-60	.1-5	Mixed Grass-Scrub	2
Herbaceous	61-80	.1-5	Mixed Grass-Scrub	2
Herbaceous	81-100	.1-5	Mixed Grass-Scrub	2
Shrubland	11-25	.1-5	Rabbitbrush	2
Shrubland	26-60	.1-5	Rabbitbrush	2
Shrubland	61-80	.1-5	Rabbitbrush	2
Shrubland	81-100	.1-5	Rabbitbrush	2
Woodland	26-60	10.1 and above	Cottonwood w/grass	2
Woodland	61-80	10.1 and above	Cottonwood w/grass	2
Woodland	81-100	10.1 and above	Cottonwood w/grass	2
Woodland	81-100	10.1 and above	Soapberry w/grass	2
Shrubland	81-100	5.1-10	Mesquite w/grass	2
Woodland	26-60	5.1-10	Mesquite w/grass	2
Woodland	61-80	5.1-10	Mesquite w/grass	2
Woodland	81-100	5.1-10	Mesquite w/grass	2
Woodland	61-80	5.1-10	Soapberry w/grass	2
Woodland	81-100	5.1-10	Soapberry w/grass	2
Woodland	61-80	5.1-10	Willow w/grass	2
Herbaceous	26-60	.1-5	Johnson Grass	3
Herbaceous	61-80	.1-5	Johnson Grass	3
Herbaceous	81-100	.1-5	Johnson Grass	3
Shrubland	11-25	.1-5	Mesquite/Sacaton	3
Shrubland	26-60	.1-5	Mesquite/Sacaton	3
Shrubland	61-80	.1-5	Mesquite/Sacaton	3
Shrubland	81-100	.1-5	Mesquite/Sacaton	3
Herbaceous	11-25	.1-5	Sacaton	3
Herbaceous	26-60	.1-5	Sacaton	3
Herbaceous	61-80	.1-5	Sacaton	3
Herbaceous	81-100	.1-5	Sacaton	3
Herbaceous	26-60	.1-5	Sacaton/Tobosa	3
Herbaceous	61-80	.1-5	Sacaton/Tobosa	3
Herbaceous	81-100	.1-5	Sacaton/Tobosa	3
Shrubland	81-100	5.1-10	Mesquite/Sacaton	3
Woodland	26-60	5.1-10	Mesquite/Sacaton	3
Woodland	61-80	5.1-10	Mesquite/Sacaton	3
Herbaceous	61-80	.1-5	Creosote-Tarbush	4
Shrubland	26-60	.1-5	Cottonwood w/shrub	5
Herbaceous	11-25	.1-5	Mixed Forbs	5
Herbaceous	26-60	.1-5	Mixed Forbs	5
Herbaceous	61-80	.1-5	Mixed Forbs	5
Herbaceous	81-100	.1-5	Mixed Forbs	5
Herbaceous	26-60	.1-5	Mixed Upland Scrub	5
Herbaceous	11-25	.1-5	Whitethorn	5
Herbaceous	26-60	.1-5	Whitethorn	5
Herbaceous	61-80	.1-5	Whitethorn	5
Shrubland	11-25	.1-5	Whitethorn	5
Shrubland	26-60	.1-5	Whitethorn	5
Shrubland	61-80	.1-5	Whitethorn	5
Forest	26-60	10.1 and above	Cottonwood w/shrub	5
Forest	81-100	5.1-10	Cottonwood w/shrub	5
Herbaceous	1-10	.1-5	Creosote-Tarbush	6
Herbaceous	11-25	.1-5	Creosote-Tarbush	6
Herbaceous	26-60	.1-5	Creosote-Tarbush	6
Shrubland	11-25	.1-5	Creosote-Tarbush	6
Shrubland	26-60	.1-5	Creosote-Tarbush	6
Shrubland	61-80	.1-5	Creosote-Tarbush	6
Shrubland	81-100	.1-5	Creosote-Tarbush	6
Forest	61-80	.1-5	Mesquite	6
Shrubland	61-80	.1-5	Mesquite w/shrub	6
Shrubland	11-25	.1-5	Mixed Upland Scrub	6
Shrubland	26-60	.1-5	Mixed Upland Scrub	6
Shrubland	61-80	.1-5	Mixed Upland Scrub	6
Shrubland	81-100	.1-5	Mixed Upland Scrub	6
Shrubland	11-25	.1-5	Saltcedar	6
Shrubland	26-60	.1-5	Saltcedar	6
Shrubland	61-80	.1-5	Saltcedar	6
Shrubland	81-100	.1-5	Saltcedar	6
Woodland	26-60	10.1 and above	Mesquite w/shrub	6
Woodland	26-60	5.1-10	Mesquite w/shrub	6
Woodland	61-80	5.1-10	Mesquite w/shrub	6
Woodland	81-100	5.1-10	Mesquite w/shrub	6
Forest	61-80	5.1-10	Saltcedar	6
Forest	81-100	5.1-10	Saltcedar	6
Woodland	81-100	5.1-10	Saltcedar w/shrub	6
Shrubland	26-60	.1-5	Beebush/Acacia	8
Shrubland	61-80	.1-5	Beebush/Acacia	8
Forest	26-60	.1-5	Mesquite	8
Shrubland	11-25	.1-5	Mesquite	8
Shrubland	26-60	.1-5	Mesquite	8
Shrubland	61-80	.1-5	Mesquite	8
Shrubland	81-100	.1-5	Mesquite	8
Forest	61-80	10.1 and above	Cottonwood	8
Forest	81-100	10.1 and above	Cottonwood	8
Woodland	26-60	10.1 and above	Cottonwood w/open	8
Woodland	61-80	10.1 and above	Cottonwood w/open	8
Woodland	26-60	10.1 and above	Cottonwood w/shrub	8
Woodland	61-80	10.1 and above	Cottonwood w/shrub	8
Woodland	81-100	10.1 and above	Cottonwood w/shrub	8
Forest	81-100	10.1 and above	Mesquite	8
Woodland	81-100	10.1 and above	Mesquite	8
Woodland	26-60	5.1-10	Cottonwood w/open	8
Woodland	26-60	5.1-10	Cottonwood w/shrub	8
Woodland	61-80	5.1-10	Cottonwood w/shrub	8
Forest	61-80	5.1-10	Mesquite	8
Forest	81-100	5.1-10	Mesquite	8
Shrubland	61-80	5.1-10	Mesquite	8
Shrubland	81-100	5.1-10	Mesquite	8
Woodland	81-100	5.1-10	Mesquite	8
Woodland	26-60	5.1-10	Mesquite w/open	8
Forest	81-100	5.1-10	Soapberry	8
Forest	61-80	5.1-10	Willow	8

Appendix J: Community Collaboration / Cooperation

When they function properly, collaborative endeavors between agencies, stakeholder groups and other interested parties use the strengths of individuals and organizations to maximize the benefits to the group. Collaborative stewardship processes have been used in ecosystem management for about a decade (Ouachita National Forest, Catron County Citizens Group, Greater Flagstaff Forest Partnership, Flathead Partnership, The Hayfork Watershed Center, among many others). The following is a summary of the major elements found in successful collaborations.

Focus of Collaboration: The focus in collaboration should be upon integrating social, economic, and ecological factors or dimensions in forest management. Examples of this have occurred in forest planning, watershed rehabilitation, and forest restoration. The words defining and describing this work include participation, democracy, public involvement, openness, trust, shared responsibility, reaching common ground, honesty, listening and learning.

Success Factors: Certain qualities or principles make collaboration successful. Here are a few: representation and access; information exchange and learning; continuity of participation (Moote and McClaran, 1997). Clear objectives and projects; manage the process carefully, consistently and continually, and connect implementation to planning (RESOLVE 2001).

Barriers and Roadblocks: Collaborative processes may face hurdles that will have to be overcome. These include domination by the convening party; inability of the partners to listen to each other; the facilitating agency did not have proper authority; perception of responsibility among the partners was unclear; the project or partnership objectives were unrealistic (Lugenbill,2003).

History of Collaboration in Fire Management: After several large fires occurred in the early 1980's, efforts were made to understand public perceptions of fire. Some of these research efforts have been called public acceptability studies, and include the acceptance of smoke, of processes of prescribed fire planning and management, and of fire impacts on social values such as wildlife (Taylor, Jonathan and Terry Daniel. 1984; Taylor, Jonathan et al. 1988).

The 2000 wildfire season changed the thinking towards the wildland urban interface, and we witnessed an emerging cluster of actions that has become known as the National Fire Plan (NFP). The NFP states, "that a collaborative structure - with States and local governments as full partners, will be the most efficient and effective way of implementing a long-term program." It notes a congressional directive that a strategy will be developed with "close collaboration among citizens and governments at all levels (10-Year Strategy, Western Governor's Association, 2002 and the Interior and Related Agencies Appropriations Act, FY 2001, PL 106-291).

Community Collaborative Linkages to the National Fire Plan (NFP): There are a number of dimensions that present opportunities for collaboration or partnership between agencies, communities, governments, groups, interests and associations. Work can be done using one or more of these dimensions. Working strategically, it may be possible to create a team effort to address aspects of all of these, which will likely increase the team's effectiveness and chances for success.

1. **Collaborative Planning Dimension:**

- Community or county fire plans identify hazardous fuel areas on private and public lands, improve interagency coordination. and develop community awareness and support for fuel treatment projects;
- Creates the opportunity for coordinated fuel treatments on public and private lands;
- Opens the dialogue about the wildland-urban interface boundary to include broader scale landscape issues such as water quality, scenic vistas, and amenity-based economies.

2. **The Social Dimension - Community Organization:**

- Communities can begin working on a neighbor-to-neighbor basis regarding fire prevention education and mitigation;
- Establish a cooperative effort with regard to slash disposal or removal;
- Creation of a community fire safe council;
- Continually building up of regional/county capacity can occur: Example in Southwestern Colorado, County Fire planning in 2001, Missionary Ridge Fire in 2002, and the Pinion pine die-off / problem solving. In 2003, the fire prevention campaign "What are You Waiting for?" was developed.

3. **The Economic Dimension- Sustainability:**

- Inclusion of the wood products industry and fuel thinning businesses:
- Creation of private businesses to assist with fuel reduction;
- Produce value added uses of resultant raw material from fuel treatments;
- Build a well-integrated, sustainable relationship between the economic and ecological dimensions to produce healthy forests.

4. **The Information/Communication Dimension - Depth and Continuity:**

- Information gaps exist about the natural role of fire, how fires behave, and when and where they can be suppressed (People and Fire in Western Colorado, 2003);

- Informal networks are critical to community communication and participation;

- Readily available information is needed -- newspaper, GIS maps, radio, videos, web-based (see southwestcoloradofires.org) -- to reduce the number of people who may feel there is inadequate or inaccurate information about fires and ecosystem management, and the ecological conditions on public lands;

- Social realities are built and reinforced during and after wildfires, so communication is critical to build or sustain community trust and involvement.

5. The Prevention Education/Mitigation Dimension - Community Mobilization:

- Risk reduction along the wildland urban interface is a community issue, not an individual property protection question. There are synergistic gains when mitigation is based on neighborhood responsibility and action;

- Support may be available from established community networks such as neighborhood associations, real estate trade groups, fire districts, and the Red Cross;

- Group resources can be used to plan and implement hands-on demonstration projects, conduct field tours, help with slash removal and establish neighbors to neighbor programs.

Appendix K: Glossary of Terms

Adopted from NIFC, http://www.nifc.gov/fireinfo/glossary.html

Aerial Fuels: All live and dead vegetation in the forest canopy or above surface fuels, including tree branches, twigs and cones, snags, moss, and high brush.

Aerial Ignition: Ignition of fuels by dropping incendiary devices or materials from aircraft.

Air Tanker: A fixed-wing aircraft equipped to drop fire retardants or suppressants.

Agency: Any federal, state, or county government organization participating with jurisdictional responsibilities.

Anchor Point: An advantageous location, usually a barrier to fire spread, from which to start building a fire line. An anchor point is used to reduce the chance of firefighters being flanked by fire.

Appropriate Tools: Methods for reducing hazardous fuels including prescribed fire, wildland fire use, and various mechanical methods such as crushing, tractor and hand piling, thinning (to produce commercial or pre-commercial products), and pruning. They are selected on a site-specific case and are ecologically appropriate and cost effective.

Aramid: The generic name for a high-strength, flame-resistant synthetic fabric used in the shirts and jeans of firefighters. Nomex, a brand name for aramid fabric, is the term commonly used by firefighters.

Aspect: Direction toward which a slope faces.

Backfire: A fire set along the inner edge of a fireline to consume the fuel in the path of a wildfire and/or change the direction of force of the fire's convection column.

Backpack Pump: A portable sprayer with hand-pump, fed from a liquid-filled container fitted with straps, used mainly in fire and pest control. (See also Bladder Bag.)

Bambi Bucket: A collapsible bucket slung below a helicopter. Used to dip water from a variety of sources for fire suppression.

Behave: A system of interactive computer programs for modeling fuel and fire behavior that consists of two systems: BURN and FUEL.

Bladder Bag: A collapsible backpack portable sprayer made of neoprene or high-strength nylon fabric fitted with a pump. (See also Backpack Pump.)

Blow-up: A sudden increase in fire intensity or rate of spread strong enough to prevent direct control or to upset control plans. Blow-ups are often accompanied by violent convection and may have other characteristics of a fire storm. (See Flare-up.)

Brush: A collective term that refers to stands of vegetation dominated by shrubby, woody plants, or low growing trees, usually of a type undesirable for livestock or timber management.

Brush Fire: A fire burning in vegetation that is predominantly shrubs, brush and scrub growth.

Bucket Drops: The dropping of fire retardants or suppressants from specially designed buckets slung below a helicopter.

Buffer Zones: An area of reduced vegetation that separates wildlands from vulnerable residential or business developments. This barrier is similar to a greenbelt in that it is usually used for another purpose such as agriculture, recreation areas, parks, or golf courses.

Bump-up Method: A progressive method of building a fire line on a wildfire without changing relative positions in the line. Work is begun with a suitable space between workers. Whenever one worker overtakes another, all workers ahead move one space forward and resume work on the uncompleted part of the line. The last worker does not move ahead until completing his or her space.

Burnable Acres: Any vegetative material / type that is susceptible to burning.

Burned Area Rehabilitation: The treatment of an ecosystem following disturbance to minimize subsequent effects. (1995 Federal Wildland Fire Policy.)

Burn Out: Setting fire inside a control line to widen it or consume fuel between the edge of the fire and the control line.

Burning Ban: A declared ban on open air burning within a specified area, usually due to sustained high fire danger.

Burning Conditions: The state of the combined factors of the environment that affect fire behavior in a specified fuel type.

Burning Index: An estimate of the potential difficulty of fire containment as it relates to the flame length at the most rapidly spreading portion of a fire's perimeter.

Burning Period: That part of each 24-hour period when fires spread most rapidly, typically from 10:00 a.m. to sundown.

Burn Intensity: The amount and rate of surface fuel consumption. It is not a good indicator of the degree of chemical, physical and biological changes to the soil or other resources (see Fire Severity).

Campfire: As used to classify the cause of a wildland fire, a fire that was started for cooking or warming that spreads sufficiently from its source to require action by a fire control agency.

Candle or Candling: A single tree or a very small clump of trees which is burning from the bottom up.

Chain: A unit of linear measurement equal to 66 feet.

Closure: Legal restriction, but not necessarily elimination of specified activities such as smoking, camping, or entry that might cause fires in a given area.

Cold Front: The leading edge of a relatively cold air mass that displaces warmer air. The heavier cold air may cause some of the warm air to be lifted. If the lifted air contains enough moisture, the result may be cloudiness, precipitation, and thunderstorms. If both air masses are dry, no clouds may form. Following the passage of a cold front in the Northern Hemisphere, westerly or northwesterly winds of 15 to 30 or more miles per hour often continue for 12 to 24 hours.

Cold Trailing: A method of controlling a partly dead fire edge by carefully inspecting and feeling with the hand for heat to detect any fire, digging out every live spot, and trenching any live edge.

Command Staff: The command staff consists of the information officer, safety officer and liaison officer. They report directly to the incident commander and may have assistants.

Community Impact Zone (CIZ): The zone around a community that may be impacted by wildfire. Similar to Defensible Space, but on a community level.

Complex: Two or more individual incidents located in the same general area which are assigned to a single incident commander or unified command.

Condition Class: Based on coarse scale national data, Fire Condition Classes measure general wildfire risk as follows:

> Condition Class 1. For the most part, fire regimes in this Fire Condition Class are within historical ranges. Vegetation composition and structure are intact. Thus, the risk of losing key ecosystem components from the occurrence of fire remains relatively low.
>
> Condition Class 2. Fire regimes on these lands have been moderately altered from their historical range by either increased or decreased fire frequency. A moderate risk of losing key ecosystem components has been identified on these lands.
>
> Condition Class 3. Fire regimes on these lands have been significantly altered from their historical return interval. The risk of losing key ecosystem components from fire is high. Fire frequencies have departed from historical ranges by multiple return intervals. Vegetation composition, structure and diversity have been significantly altered. Consequently, these lands verge on the greatest risk of ecological collapse. (Cohesive Strategy, 2002, in draft)

Contain a fire: A fuel break around the fire has been completed. This break may include natural barriers or manually and/or mechanically constructed line.

Control a fire: The complete extinguishment of a fire, including spot fires. Fireline has been strengthened so that flare-ups from within the perimeter of the fire will not break through this line.

Control Line: All built or natural fire barriers and treated fire edge used to control a fire.

Cooperating Agency: An agency supplying assistance other than direct suppression, rescue, support, or service functions to the incident control effort; e.g., Red Cross, law enforcement agency, telephone company, etc.

Coyote Tactics: A progressive line construction duty involving self-sufficient crews that build fire line until the end of the operational period, remain at or near the point while off duty, and begin building fire line again the next operational period where they left off.

Creeping Fire: Fire burning with a low flame and spreading slowly.

Crew Boss: A person in supervisory charge of usually 16 to 21 firefighters and responsible for their performance, safety, and welfare.

Critical Ignition Zones: Those areas that are likely to be key in the formation of large wildfires if ignition occurs at that location. These include locations such as at the toe of a hill, or in fuels that will ignite easily and sustain growth of fire with increasing flame lengths and fire intensity.

Crown Fire (Crowning): The movement of fire through the crowns of trees or shrubs more or less independently of the surface fire.

Curing: Drying and browning of herbaceous vegetation or slash.

Dead Fuels: Fuels with no living tissue in which moisture content is governed almost entirely by atmospheric moisture (relative humidity and precipitation), dry-bulb temperature, and solar radiation.

Debris Burning: A fire spreading from any fire originally set for the purpose of clearing land or for rubbish, garbage, range, stubble, or meadow burning.

Defensible Space: An area either natural or manmade where material capable of causing a fire to spread has been treated, cleared, reduced, or changed to act as a barrier between an advancing wildland fire and the loss to life, property, or resources. In practice, "defensible space" is defined as an area a minimum of 30 feet around a structure that is cleared of flammable brush or vegetation. See Survivable Space.

Deployment: See Fire Shelter Deployment.

Detection: The act or system of discovering and locating fires.

Direct Attack: Any treatment of burning fuel, such as by wetting, smothering, or chemically quenching the fire or by physically separating burning from unburned fuel.

Dispatch: The implementation of a command decision to move a resource or resources from one place to another.

Dispatcher: A person employed who receives reports of discovery and status of fires, confirms their locations, takes action promptly to provide people and equipment likely to be needed for control in first attack, and sends them to the proper place.

Dispatch Center: A facility from which resources are directly assigned to an incident.

Division: Divisions are used to divide an incident into geographical areas of operation. Divisions are established when the number of resources exceeds the span-of-control of the operations chief. A division is located with the Incident Command System organization between the branch and the task force/strike team.

Dozer: Any tracked vehicle with a front-mounted blade used for exposing mineral soil.

Dozer Line: Fire line constructed by the front blade of a dozer.

Drip Torch: Hand-held device for igniting fires by dripping flaming liquid fuel on the materials to be burned; consists of a fuel fount, burner arm, and igniter. Fuel used is generally a mixture of diesel and gasoline.

Drop Zone: Target area for air tankers, helitankers, and cargo dropping.

Drought Index: A number representing net effect of evaporation, transpiration, and precipitation in producing cumulative moisture depletion in deep duff or upper soil layers.

Dry Lightning Storm: Thunderstorm in which negligible precipitation reaches the ground. Also called a dry storm.

Duff: The layer of decomposing organic materials lying below the litter layer of freshly fallen twigs, needles, and leaves and immediately above the mineral soil.

Ecosystem: A spatially explicit, relative homogeneous unit of the Earth that includes all interacting organisms and components of any part of the natural environment within its boundaries. An ecosystem can be of any size, e.g., a log, pond, field, forest, or the Earth's biosphere (Society of American Foresters, 1998).

Ecosystem Integrity: The completeness of an ecosystem that at geographic and temporal scales maintains its characteristics diversity of biological and physical components, composition, structure, and function (Cohesive Strategy, 2000).

Energy Release Component (ERC): The computed total heat released per unit area (British thermal units per square foot) within the fire front at the head of a moving fire.

Engine: Any ground vehicle providing specified levels of pumping, water and hose capacity.

Engine Crew: Firefighters assigned to an engine. The Fireline Handbook defines the minimum crew makeup by engine type.

Entrapment: A situation where personnel are unexpectedly caught in a fire behavior-related, life-threatening position where planned escape routes or safety zones are absent, inadequate, or compromised. An entrapment may or may not include deployment of a fire shelter for its intended purpose. These situations may or may not result in injury. They include "near misses."

Environmental Assessment (EA): EAs were authorized by the National Environmental Policy Act (NEPA) of 1969. They are concise, analytical documents prepared with public participation that determine if an Environmental Impact Statement (EIS) is needed for a particular project or action. If an EA determines an EIS is not needed, the EA becomes the document allowing agency compliance with NEPA requirements.

Environmental Impact Statement (EIS): EISs were authorized by the National Environmental Policy Act (NEPA) of 1969. Prepared with public participation, they assist decision makers by providing information, analysis and an array of action alternatives, allowing managers to see the probable effects of decisions on the environment. Generally, EISs are written for large-scale actions or geographical areas.

Equilibrium Moisture Content: Moisture content that a fuel particle will attain if exposed for an infinite period in an environment of specified constant temperature and humidity. When a fuel particle reaches equilibrium moisture content, net exchange of moisture between it and the environment is zero.

Escape Route: A preplanned and understood route firefighters take to move to a safety zone or other low-risk area, such as an already burned area, previously constructed safety area, a meadow that won't burn, natural rocky area that is large enough to take refuge without being burned. When escape routes deviate from a defined physical path, they should be clearly marked (flagged).

Escaped Fire: A fire which has exceeded or is expected to exceed initial attack capabilities or prescription.

Extended Attack Incident: A wildland fire that has not been contained or controlled by initial attack forces and for which more firefighting resources are arriving, en route, or being ordered by the initial attack incident commander.

Extreme Fire Behavior: "Extreme" implies a level of fire behavior characteristics that ordinarily precludes methods of direct control action. One of more of the following is usually involved: high rate of spread, prolific crowning and/or spotting, presence of fire whirls, strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.

Faller: A person who fells trees. Also called a sawyer or cutter.

Field Observer: Person responsible to the Situation Unit Leader for collecting and reporting information about an incident obtained from personal observations and interviews.

Fine (Light) Fuels: Fast-drying fuels, generally with a comparatively high surface area-to-volume ratio, which are less than 1/4-inch in diameter and have a timelag of one hour or less. These fuels readily ignite and are rapidly consumed by fire when dry.

Fingers of a Fire: The long narrow extensions of a fire projecting from the main body.

Fire Behavior: The manner in which a fire reacts to the influences of fuel, weather and topography.

Fire Behavior Forecast: Prediction of probable fire behavior, usually prepared by a Fire Behavior Officer, in support of fire suppression or prescribed burning operations.

Fire Behavior Specialist: A person responsible to the Planning Section Chief for establishing a weather data collection system and for developing fire behavior predictions based on fire history, fuel, weather and topography.

Fire Break: A natural or constructed barrier used to stop or check fires that may occur, or to provide a control line from which to work.

Fire Cache: A supply of fire tools and equipment assembled in planned quantities or standard units at a strategic point for exclusive use in fire suppression.

Fire Crew: An organized group of firefighters under the leadership of a crew leader or other designated official.

Fire Defense System: The cumulative effect of the fire suppression system of a community, including fuels reduction programs, fire breaks, defensible space, and the response capabilities of emergency personnel.

Fire Frequency: The natural return interval for a particular ecosystem.

Fire Front: The part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified the fire front is assumed to be the leading edge of the fire perimeter. In ground fires, the fire front may be mainly smoldering combustion.

Fire Hazard Reduction Zone: Home ignition zone area, where fuel reduction and home fire resistant projects should take place to reduce the risk of a wildfire damaging a structure.

Fire Intensity: A general term relating to the heat energy released by a fire.

Fire Line: A linear fire barrier that is scraped or dug to mineral soil.

Fire Load: The number and size of fires historically experienced on a specified unit over a specified period (usually one day) at a specified index of fire danger.

Fire Management Plan (FMP): A strategic plan that defines a program to manage wildland and prescribed fires and documents the Fire Management Program in the approved land use plan. The plan is supplemented by operational plans such as preparedness plans, preplanned dispatch plans, prescribed fire plans, and prevention plans.

Fire Management Planning: A generic term referring to all levels and categories of fire management planning, including: preparedness, prevention, hazardous risk assessment, and mitigation planning.

Fire Perimeter: The entire outer edge or boundary of a fire.

Fire-prone Ecosystem: Ecosystems that historically burned intensely at low frequencies (stand replacing fires), those that burned with low intensity at a high frequency (understory fires), and those that burned very infrequently historically, but are not subject to much more frequent fires because of changed conditions. These include fire-influenced and fire-adapted ecosystems (Cohesive Strategy, 2000).

Fire Regime: A generalized description of the role fire plays in an ecosystem. It is characterized by fire frequency, predictability, seasonality, intensity, duration, scale (patch size), as well as regularity or variability. Five combinations of fire frequency, expressed as fire return interval in fire severity, are defined:

Groups I and II include fire return intervals in the 0 - 35 year range. Group I includes Ponderosa pine, other long needle pine species, and dry site Douglas fir. Group II includes the drier grassland types, tall grass prairie, and some Pacific chaparral ecosystems.

Groups III and IV include fire return internals in the 35 - 100+ year range. Group III includes interior dry site shrub communities such as sagebrush and chaparral ecosystems. Group IV includes lodgepole pine and jack pine.

Group V is the long interval (infrequent), stand replacement fire regime and includes temperate rain forest, boreal forest, and high elevation conifer species.

Fire Risk Reduction Zone: A zone targeted for risk reduction, including measures such as fuels reduction, access protection, and construction of structures to minimize the risk of ignition form wildfire.

Fire Season: 1) Period(s) of the year during which wildland fires are likely to occur, spread, and affect resource values sufficient to warrant organized fire management activities. 2) A legally enacted time during which burning activities are regulated by state or local authority.

Fire Severity: The amount of heat that is released by a fire and how it affects other resources. It is dependant on the type of fuels and the behavior of the fuels when they are burned.(see Burn Intensity).

Fire Shelter: An aluminized tent offering protection by means of reflecting radiant heat and providing a volume of breathable air in a fire entrapment situation. Fire shelters should only be used in life-threatening situations, as a last resort.

Fire Shelter Deployment: The removing of a fire shelter from its case and using it as protection against fire.

Fire Storm: Violent convection caused by a large continuous area of intense fire. Often characterized by destructively violent surface indrafts, near and beyond the perimeter, and sometimes by tornado-like whirls.

Fire Triangle: Instructional aid in which the sides of a triangle are used to represent the three factors (oxygen, heat, fuel) necessary for combustion and flame production; removal of any of the three factors causes flame production to cease.

Fire Use Module (Prescribed Fire Module): A team of skilled and mobile personnel dedicated primarily to prescribed fire management. These are national and interagency resources, available throughout the prescribed fire season, that can ignite, hold and monitor prescribed fires.

Fire Use: The combination of wildland fire use and prescribed fire application to meet resource objectives.

Fire Weather: Weather conditions that influence fire ignition, behavior and suppression.

Fire Weather Watch: A term used by fire weather forecasters to notify using agencies, usually 24 to 72 hours ahead of the event, that current and developing meteorological conditions may evolve into dangerous fire weather.

Fire Whirl: Spinning vortex column of ascending hot air and gases rising from a fire and carrying aloft smoke, debris, and flame. Fire whirls range in size from less than one foot to more than 500 feet in diameter. Large fire whirls have the intensity of a small tornado.

FIREWISE: A public education program developed by the National Wildland Fire Coordinating Group that assists communities located in proximity to fire-prone lands. (For additional information visit the Web site at http://www.firewise.org)

Firefighting Resources: All people and major items of equipment that can or potentially could be assigned to fires.

Flame Height: The average maximum vertical extension of flames at the leading edge of the fire front. Occasional flashes that rise above the general level of flames are not considered. This distance is less than the flame length if flames are tilted due to wind or slope.

Flame Length: The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface); an indicator of fire intensity.

Flaming Front: The zone of a moving fire where the combustion is primarily flaming. Behind this flaming zone combustion is primarily glowing. Light fuels typically have a shallow flaming front, whereas heavy fuels have a deeper front. Also called fire front.

Flanks of a Fire: The parts of a fire's perimeter that are roughly parallel to the main direction of spread.

Flare-up: Any sudden acceleration of fire spread or intensification of a fire. Unlike a blow-up, a flare-up lasts a relatively short time and does not radically change control plans.

Flash Fuels: Fuels such as grass, leaves, draped pine needles, fern, tree moss and some kinds of slash, that ignite readily and are consumed rapidly when dry. Also called fine fuels.

Forb: A plant with a soft, rather than permanent woody stem, that is not a grass or grass-like plant.

Fuel: Combustible material. Includes, vegetation, such as grass, leaves, ground litter, plants, shrubs and trees, that feed a fire. (See Surface Fuels.)

Fuel Bed: An array of fuels usually constructed with specific loading, depth and particle size to meet experimental requirements; also, commonly used to describe the fuel composition in natural settings.

Fuel Loading: The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area.

Fuel Model: Simulated fuel complex (or combination of vegetation types) for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.

Fuel Moisture (Fuel Moisture Content): The quantity of moisture in fuel expressed as a percentage of the weight when thoroughly dried at 212 degrees Fahrenheit.

Fuel Reduction: Manipulation, including combustion, or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control. Incorporated within this are treatments to protect, maintain, and restore land health and desired fire cycles.

Fuel Type: An identifiable association of fuel elements of a distinctive plant species, form, size, arrangement, or other characteristics that will cause a predictable rate of fire spread or difficulty of control under specified weather conditions.

Fusee: A colored flare designed as a railway warning device and widely used to ignite suppression and prescription fires.

General Staff: The group of incident management personnel reporting to the incident commander. They may each have a deputy, as needed. Staff consists of operations section chief, planning section chief, logistics section chief, and finance/administration section chief.

Geographic Area: A political boundary designated by the wildland fire protection agencies, where these agencies work together in the coordination and effective utilization

Ground Fuel: All combustible materials below the surface litter, including duff, tree or shrub roots, punchy wood, peat, and sawdust, that normally support a glowing combustion without flame.

Haines Index: An atmospheric index used to indicate the potential for wildfire growth by measuring the stability and dryness of the air over a fire.

Hand Line: A fireline built with hand tools.

Hazard Reduction: Any treatment of a hazard that reduces the threat of ignition and fire intensity or rate of spread.

Hazardous Fuels Reduction: "Fuel Reduction" is defined as the manipulation or removal of fuels, including combustion, to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control. Incorporated within this are treatments to protect, maintain, and restore land health and desired fire cycles. "Hazard Reduction" is defined as any treatment of a hazard that reduces the threat of ignition and fire intensity or rate of spread.

Head of a Fire: The side of the fire having the fastest rate of spread.

Heavy Fuels: Fuels of large diameter such as snags, logs, large limb wood, that ignite and are consumed more slowly than flash fuels.

Helibase: The main location within the general incident area for parking, fueling, maintaining, and loading helicopters. The helibase is usually located at or near the incident base.

Helispot: A temporary landing spot for helicopters.

Helitack: The use of helicopters to transport crews, equipment, and fire retardants or suppressants to the fire line during the initial stages of a fire.

Helitack Crew: A group of firefighters trained in the technical and logistical use of helicopters for fire suppression.

Holding Actions: Planned actions required to achieve wildland prescribed fire management objectives. These actions have specific implementation timeframes for fire use actions but can have less sensitive implementation demands for suppression actions.

Holding Resources: Firefighting personnel and equipment assigned to do all required fire suppression work following fireline construction but generally not including extensive mop-up.

Home Ignitability: The ignition potential within the Home Ignition Zone.

Home Ignition Zone: The home and its immediate surroundings. The home ignition zone extends to a few tens of meters around a home not hundreds of meters or beyond. Home ignitions and thus, the WUI fire loss problem principally depend on home ignitability.

Hose Lay: Arrangement of connected lengths of fire hose and accessories on the ground, beginning at the first pumping unit and ending at the point of water delivery.

Hotshot Crew: A highly trained fire crew used mainly to build fireline by hand.

Hotspot: A particular active part of a fire.

Hotspotting: Reducing or stopping the spread of fire at points of particularly rapid rate of spread or special threat, generally the first step in prompt control, with emphasis on first priorities.

Incident: A human-caused or natural occurrence, such as wildland fire, that requires emergency service action to prevent or reduce the loss of life or damage to property or natural resources.

Incident Action Plan (IAP): Contains objectives reflecting the overall incident strategy and specific tactical actions and supporting information for the next operational period. The plan may be oral or written. When written, the plan may have a number of attachments, including: incident objectives, organization assignment list, division assignment, incident radio communication plan, medical plan, traffic plan, safety plan, and incident map.

Incident Command Post (ICP): Location at which primary command functions are executed. The ICP may be co-located with the incident base or other incident facilities.

Incident Command System (ICS): The combination of facilities, equipment, personnel, procedure and communications operating within a common organizational structure, with responsibility for the management of assigned resources to effectively accomplish stated objectives pertaining to an incident.

Incident Commander: Individual responsible for the management of all incident operations at the incident site.

Incident Management Team: The incident commander and appropriate general or command staff personnel assigned to manage an incident.

Incident Objectives: Statements of guidance and direction necessary for selection of appropriate strategy(ies), and the tactical direction of resources. Incident objectives are based on realistic expectations of what can be accomplished when all allocated resources have been effectively deployed.

Indigenous Knowledge: Knowledge of a particular region or environment from an individual or group that lives in that particular region or environment, e.g., traditional ecological knowledge of American Indians (FS National Resource Book on American Indian and Alaskan Native Relations, 1997).

Infrared Detection: The use of heat sensing equipment, known as Infrared Scanners, for detection of heat sources that are not visually detectable by the normal surveillance methods of either ground or air patrols.

Initial Attack: The actions taken by the first resources to arrive at a wildfire to protect lives and property, and prevent further extension of the fire.

Job Hazard Analysis: This analysis of a project is completed by staff to identify hazards to employees and the public. It identifies hazards, corrective actions and the required safety equipment to ensure public and employee safety.

Jump Spot: Selected landing area for smokejumpers.

Jump Suit: Approved protection suite work by smokejumpers.

Keech Byram Drought Index (KBDI): Commonly-used drought index adapted for fire management applications, with a numerical range from 0 (no moisture deficiency) to 800 (maximum drought).

Knock Down: To reduce the flame or heat on the more vigorously burning parts of a fire edge.

Ladder Fuels: Fuels which provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. They help initiate and assure the continuation of crowning.

Large Fire: 1) For statistical purposes, a fire burning more than a specified area of land e.g., 300 acres. 2) A fire burning with a size and intensity such that its behavior is determined by interaction between its own convection column and weather conditions above the surface.

Lead Plane: Aircraft with pilot used to make dry runs over the target area to check wing and smoke conditions and topography and to lead air tankers to targets and supervise their drops.

Light (Fine) Fuels: Fast-drying fuels, generally with a comparatively high surface area-to-volume ratio, which are less than 1/4-inch in diameter and have a timelag of one hour or less. These fuels readily ignite and are rapidly consumed by fire when dry.

Lightning Activity Level (LAL): A number, on a scale of 1 to 6, that reflects frequency and character of cloud-to-ground lightning. The scale is exponential, based on powers of 2 (i.e., LAL 3 indicates twice the lightning of LAL 2).

Line Scout: A firefighter who determines the location of a fire line.

Litter: Top layer of the forest, scrubland, or grassland floor, directly above the fermentation layer, composed of loose debris of dead sticks, branches, twigs, and recently fallen leaves or needles, little altered in structure by decomposition.

Live Fuels: Living plants, such as trees, grasses, and shrubs, in which the seasonal moisture content cycle is controlled largely by internal physiological mechanisms, rather than by external weather influences.**M**icro-Remote Environmental Monitoring System (Micro-REMS): Mobile weather monitoring station. A Micro-REMS usually accompanies an incident meteorologist and ATMU to an incident.

Mineral Soil: Soil layers below the predominantly organic horizons; soil with little combustible material.

Mobilization: The process and procedures used by all organizations, federal, state and local for activating, assembling, and transporting all resources that have been requested to respond to or support an incident.

Modular Airborne Firefighting System (MAFFS): A manufactured unit consisting of five interconnecting tanks, a control pallet, and a nozzle pallet, with a capacity of 3,000 gallons, designed to be rapidly mounted inside an unmodified C-130 (Hercules) cargo aircraft for use in dropping retardant on wildland fires.

Mop-up: To make a fire safe or reduce residual smoke after the fire has been controlled by extinguishing or removing burning material along or near the control line, felling snags, or moving logs so they won't roll downhill.

Multi-Agency Coordination (MAC): A generalized term which describes the functions and activities of representatives of involved agencies and/or jurisdictions who come together to make decisions regarding the prioritizing of incidents, and the sharing and use of critical resources. The MAC organization is not a part of the on-scene ICS and is not involved in developing incident strategy or tactics.

Mutual Aid Agreement: Written agreement between agencies and/or jurisdictions in which they agree to assist one another upon request, by furnishing personnel and equipment.

National Environmental Policy Act (NEPA): NEPA is the basic national law for protection of the environment, passed by Congress in 1969. It sets policy and procedures for environmental protection, and authorizes Environmental Impact Statements and Environmental Assessments to be used as analytical tools to help federal managers make decisions.

National Fire Danger Rating System (NFDRS): A uniform fire danger rating system that focuses on the environmental factors that control the moisture content of fuels.

National Wildfire Coordinating Group: A group formed under the direction of the Secretaries of Agriculture and the Interior and comprised of representatives of the U.S. Forest Service, Bureau of Land Management, Bureau of Indian Affairs, National Park Service, U.S. Fish and Wildlife Service and Association of State Foresters. The group's purpose is to facilitate coordination and effectiveness of wildland fire activities and provide a forum to discuss, recommend action, or resolve issues and problems of substantive nature. NWCG is the certifying body for all courses in the National Fire Curriculum.

Nomex ®: Trade name for a fire resistant synthetic material used in the manufacturing of flight suits and pants and shirts used by firefighters (see Aramid).

Normal Fire Season: 1) A season when weather, fire danger, and number and distribution of fires are about average. 2) Period of the year that normally comprises the fire season.

Operations Branch Director: Person under the direction of the operations section chief who is responsible for implementing that portion of the incident action plan appropriate to the branch.

Operational Period: The period of time scheduled for execution of a given set of tactical actions as specified in the Incident Action Plan. Operational periods can be of various lengths, although usually not more than 24 hours.

Overhead: People assigned to supervisory positions, including incident commanders, command staff, general staff, directors, supervisors, and unit leaders.

Pack Test: Used to determine the aerobic capacity of fire suppression and support personnel and assign physical fitness scores. The test consists of walking a specified distance, with or without a weighted pack, in a predetermined period of time, with altitude corrections.

Paracargo: Anything dropped, or intended for dropping, from an aircraft by parachute, by other retarding devices, or by free fall.

Peak Fire Season: That period of the fire season during which fires are expected to ignite most readily, to burn with greater than average intensity, and to create damages at an unacceptable level.

Performance Measures: A quantitative or qualitative characterization of performance (Government Performance and Results Act of 1993).

Personnel Protective Equipment (PPE): All firefighting personnel must be equipped with proper equipment and clothing in order to mitigate the risk of injury from, or exposure to, hazardous conditions encountered while working. PPE includes, but is not limited to: 8-inch high-laced leather boots with lug soles, fire shelter, hard hat with chin strap, goggles, ear plugs, aramid shirts and trousers, leather gloves and individual first aid kits.

Preparedness: Condition or degree of being ready to cope with a potential fire situation

Prescribed Fire: Any fire ignited by management actions under certain, predetermined conditions to meet specific objectives related to hazardous fuels or habitat improvement. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.

Prescribed Fire Plan (Burn Plan): This document provides the prescribed fire burn boss information needed to implement an individual prescribed fire project.

Prescription: Measurable criteria that define conditions under which a prescribed fire may be ignited, guide selection of appropriate management responses, and indicate other required actions. Prescription criteria may include safety, economic, public health, environmental, geographic, administrative, social, or legal considerations.

Prevention: Activities directed at reducing the incidence of fires, including public education, law enforcement, personal contact, and reduction of fuel hazards.

Project Fire: A fire of such size or complexity that a large organization and prolonged activity is required to suppress it.

Pulaski: A combination chopping and trenching tool, which combines a single-bitted axe-blade with a narrow adze-like trenching blade fitted to a straight handle. Useful for grubbing or trenching in duff and matted roots. Well-balanced for chopping.

Radiant Burn: A burn received from a radiant heat source.

Radiant Heat Flux: The amount of heat flowing through a given area in a given time, usually expressed as calories/square centimeter/second.

Rappelling: Technique of landing specifically trained firefighters from hovering helicopters; involves sliding down ropes with the aid of friction-producing devices.

Rate of Spread: The relative activity of a fire in extending its horizontal dimensions. It is expressed as a rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in area, depending on the intended use of the information. Usually it is expressed in chains or acres per hour for a specific period in the fire's history.

Reburn: The burning of an area that has been previously burned but that contains flammable fuel that ignites when burning conditions are more favorable; an area that has reburned.

Red Card: Fire qualification card issued to fire rated persons showing their training needs and their qualifications to fill specified fire suppression and support positions in a large fire suppression or incident organization.

Red Flag Warning: Term used by fire weather forecasters to alert forecast users to an ongoing or imminent critical fire weather pattern.

Rehabilitation: The activities necessary to repair damage or disturbance caused by wildland fires or the fire suppression activity.

Relative Humidity (Rh): The ratio of the amount of moisture in the air, to the maximum amount of moisture that air would contain if it were saturated. The ratio of the actual vapor pressure to the saturated vapor pressure.

Remote Automatic Weather Station (RAWS): An apparatus that automatically acquires, processes, and stores local weather data for later transmission to the GOES Satellite, from which the data is re-transmitted to an earth-receiving station for use in the National Fire Danger Rating System.

Resiliency: The capacity of an ecosystem to maintain or regain normal function and development following disturbance (Society of American Foresters, 1998).

Resources: 1) Personnel, equipment, services and supplies available, or potentially available, for assignment to incidents. 2) The natural resources of an area, such as timber, crass, watershed values, recreation values, and wildlife habitat.

Resource Management Plan (RMP): A document prepared by field office staff with public participation and approved by field office managers that provides general guidance and direction for land management activities at a field office. The RMP identifies the need for fire in a particular area and for a specific benefit.

Resource Order: An order placed for firefighting or support resources.

Response Time: The amount of time it takes from when a request for help is received by the emergency dispatch system until emergency personnel arrive at the scene.

Retardant: A substance or chemical agent which reduced the flammability of combustibles.

Restoration: The active or passive management of an ecosystem or habitat toward its original structure, natural compliment of species, and natural functions or ecological processes (Cohesive Strategy, 2000).

Run (of a fire): The rapid advance of the head of a fire with a marked change in fire line intensity and rate of spread from that noted before and after the advance.

Running: A rapidly spreading surface fire with a well-defined head.

Rural Fire Assistance: The Department of the Interior Rural Fire Assistance program is a multi-million dollar program to enhance the fire protection capabilities of rural fire districts. The program will assist with training, equipment purchase, and prevention activities, on a cost-share basis.

Safety Zone: An area cleared of flammable materials used for escape in the event the line is outflanked or in case a spot fire causes fuels outside the control line to render the line unsafe. In firing operations, crews progress so as to maintain a safety zone close at hand allowing the fuels inside the control line to be consumed before going ahead. Safety zones may also be constructed as integral parts of fuel breaks; they are greatly enlarged areas which can be used with relative safety by firefighters and their equipment in the event of a blowup in the vicinity.

Scratch Line: An unfinished preliminary fire line hastily established or built as an emergency measure to check the spread of fire.

Severe Wildland Fire (catastrophic wildfire): Fire that burns more intensely than the natural or historical range of variability, thereby fundamentally changing the ecosystem, destroying communities and / or rate or threatened species / habitat, or causing unacceptable erosion (GAO / T-RCED-99-79) (Society of American Foresters, 1998).

Severity Funding: Funds provided to increase wildland fire suppression response capability necessitated by abnormal weather patterns, extended drought, or other events causing abnormal increase in the fire potential and/or danger.

Single Resource: An individual, a piece of equipment and its personnel complement, or a crew or team of individuals with an identified work supervisor that can be used on an incident.

Size-up: To evaluate a fire to determine a course of action for fire suppression.

Slash: Debris left after logging, pruning, thinning or brush cutting; includes logs, chips, bark, branches, stumps and broken understory trees or brush.

Sling Load: Any cargo carried beneath a helicopter and attached by a lead line and swivel.

Slop-over: A fire edge that crosses a control line or natural barrier intended to contain the fire.

Slurry: A mixture typically of water, red clay and fertilizer dropped from air tankers for fire suppression.

Smokejumper: A firefighter who travels to fires by aircraft and parachute.

Smoke Management: Application of fire intensities and meteorological processes to minimize degradation of air quality during prescribed fires.

Smoldering Fire: A fire burning without flame and barely spreading.

Snag: A standing dead tree or part of a dead tree from which at least the smaller branches have fallen.

Spark Arrester: A device installed in a chimney, flue, or exhaust pipe to stop the emission of sparks and burning fragments.

Spot Fire: A fire ignited outside the perimeter of the main fire by flying sparks or embers.

Spot Weather Forecast: A special forecast issued to fit the time, topography, and weather of each specific fire. These forecasts are issued upon request of the user agency and are more detailed, timely, and specific than zone forecasts.

Spotter: In smokejumping, the person responsible for selecting drop targets and supervising all aspects of dropping smokejumpers.

Spotting: Behavior of a fire producing sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire.

Staging Area: Locations set up at an incident where resources can be placed while awaiting a tactical assignment on a three-minute available basis. Staging areas are managed by the operations section.

Strategy: The science and art of command as applied to the overall planning and conduct of an incident.

Strike Team: Specified combinations of the same kind and type of resources, with common communications, and a leader.

Strike Team Leader: Person responsible to a division/group supervisor for performing tactical assignments given to the strike team.

Structure Fire: Fire originating in and burning any part or all of any building, shelter, or other structure.

Suppressant: An agent, such as water or foam, used to extinguish the flaming and glowing phases of combustion when direction applied to burning fuels.

Suppression: All the work of extinguishing or containing a fire, beginning with its discovery.

Surface Fuels: Loose surface litter on the soil surface, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches that have not yet decayed enough to lose their identity; also grasses, forbs, low and medium shrubs, tree seedlings, heavier branchwood, downed logs, and stumps interspersed with or partially replacing the litter.

Survivable Space: The distance between vegetational fuels and a structure necessary to protect the building from radiant heat and its ignition mechanics. The separation distance was formerly called "Defensible Space" due to the implication that the fire department could intercede. The term "Survivable Space" eliminates the dependence on manual suppression and implies that the distance alone provides the protection. See Defensible Space.

Swamper: (1) A worker who assists fallers and/or sawyers by clearing away brush, limbs and small trees. Carries fuel, oil and tools and watches for dangerous situations. (2) A worker on a dozer crew who pulls winch line, helps maintain equipment, etc., to speed suppression work on a fire.

Tactics: Deploying and directing resources on an incident to accomplish the objectives designated by strategy.

Tanker: Either a tank truck used to deliver water from a water source to the scene of a fire, or a fixed wing aircraft used for fire suppression by dropping slurry on the flank or head of a fire.

Temporary Flight Restrictions (TFR): A restriction requested by an agency and put into effect by the Federal Aviation Administration in the vicinity of an incident which restricts the operation of nonessential aircraft in the airspace around that incident.

Terra Torch ®: Device for throwing a stream of flaming liquid, used to facilitate rapid ignition during burn out operations on a wildland fire or during a prescribed fire operation.

Test Fire: A small fire ignited within the planned burn unit to determine the characteristic of the prescribed fire, such as fire behavior, detection performance and control measures.

Timelag: Time needed under specified conditions for a fuel particle to lose about 63 percent of the difference between its initial moisture content and its equilibrium moisture content. If conditions remain unchanged, a fuel will reach 95 percent of its equilibrium moisture content after four timelag periods.

Torching: The ignition and flare-up of a tree or small group of trees, usually from bottom to top.

Two-way Radio: Radio equipment with transmitters in mobile units on the same frequency as the base station, permitting conversation in two directions using the same frequency in turn.

Type: The capability of a firefighting resource in comparison to another type. Type 1 usually means a greater capability due to power, size, or capacity.

Uncontrolled Fire: Any fire which threatens to destroy life, property, or natural resources, and

Underburn: A fire that consumes surface fuels but not trees or shrubs. (See Surface Fuels.)

Unplanned and Unwanted Wildland Fires: An unplanned and unwanted fire is one burning outside the parameters as defined in land use plans and fire management plans for that location (including areas where the fire can be expected to spread) under current and expected conditions. Unplanned and unwanted fires include fires burning in areas where fire is specifically excluded; fires that exhibit burning characteristics (intensity, frequency, and seasonality) that are outside prescribed ranges, specifically including fires expected to produce severe fire effects; unauthorized human caused fires (arson, escaped camp fires, equipment fires, etc.); and fires that occur during high fire dangers, or resource shortage, where the resources needed to manage the fire are needed for more critical fire management needs.

Unplanned is not the same as unscheduled. The time of a lightning fire ignition is not known, however, a lightning-caused fire could still be used to meet fuels and ecosystem management objectives if that type of fire is expected to burn within the parameters of an approved plan; the fire is burning within the parameters for the area; is not causing, or has the potential to cause, unacceptable effects; and funding and resources to manage the fire are available.

Vectors: Directions of fire spread as related to rate of spread calculations (in degrees from upslope).

Volunteer Fire Department (VFD): A fire department of which some or all members are unpaid.

Water Tender: A ground vehicle capable of transporting specified quantities of water.

Weather Information and Management System (WIMS): An interactive computer system designed to accommodate the weather information needs of all federal and state natural resource management agencies. Provides timely access to weather forecasts, current and historical weather data, the National Fire Danger Rating System (NFDRS), and the National Interagency Fire Management Integrated Database (NIFMID).

Wet Line: A line of water, or water and chemical retardant, sprayed along the ground, that serves as a temporary control line from which to ignite or stop a low-intensity fire.

Wildland Fire: Any nonstructure fire, other than prescribed fire, that occurs in the wildland.

Wildland Fire Implementation Plan (WFIP): A progressively developed assessment and operational management plan that documents the analysis and selection of strategies and describes the appropriate management response for a wildland fire being managed for resource benefits.

Wildland Fire Situation Analysis (WFSA): A decision-making process that evaluates alternative suppression strategies against selected environmental, social, political, and economic criteria. Provides a record of decisions.

Wildland Fire Use: The management of naturally ignited wildland fires to accomplish specific, planned resource management objectives in predefined geographic areas outlined in Fire Management Plans. Wildland fire use is not to be confused with "fire use" which includes prescribed fire.

Wildland Urban Interface (WUI): The line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. (Glossary of Wildland Fire Terminology, 1996).

Wind Vectors: Wind directions used to calculate fire behavior.

Appendix L: Wildland Urban Watch Outs

1. Wooden construction and wood shake roofs.
2. Poor access and narrow one-way roads.
3. Inadequate water supply.
4. Natural fuels 30’ or closer to the structures.
5. Extreme fire behavior.
6. Strong winds.
7. Structures in chimneys, box canyons, narrow canyons, or on steep slopes (30% or greater) in flashy fuels.
8. Bridge load limits.
9. Power lines and poles–watch for both overhead and fallen lines.
10. Propane and above ground fuel tanks with nearby vegetation or wooden improvements.
11. Evacuations of public, livestock, pets, animals are planned or occurring.
12. Local citizens attempting suppression.

Upper San Pedro Watershed

WILDFIRE HAZARD ASSESSMENT & MITIGATION PLAN

For Summary Report

A Wildland-Urban Interface

Communities-at-Risk Program